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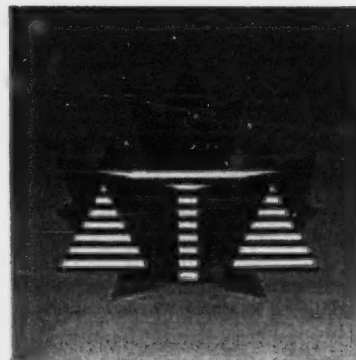
Crime and Justice Research Paper Series

Neighbourhood Characteristics and the Distribution of Crime in Regina

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Neighbourhood characteristics and the distribution of crime in Regina

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Abstract

This research paper explores the spatial distribution of crime and various social, economic and physical neighbourhood characteristics in the City of Regina. Analysis is based on police-reported crime data from the 1999, 2001, and 2003 Incident-based Uniform Crime Reporting Survey (UCR2), the 2001 Census of Population, 1999 and 2003 Small Area and Administrative data from tax filers, and City of Regina zoning and land-use data.

In general, results support previous research suggesting that crime is not randomly distributed within cities, but is associated with the distribution of other factors related to the population and land-uses of the city. When all other factors are taken into account, results indicate that higher levels of crime occur in neighbourhoods with lower levels of income and education, and higher proportions of young males. Housing related issues also have an impact on levels of neighbourhood crime. Neighbourhoods with higher proportions of renters, as opposed to home-owners, tend to have higher rates of violent crime while property crime rates tend to be higher in neighbourhoods with greater proportions of older housing.

Exploratory analysis supports previous research indicating that neighbourhoods with high violent crime rates tend to experience drops in population over time. Building on earlier results that income levels in a neighbourhood act as a predictor of crime, this study further showed that high income neighbourhoods had significantly lower property crime rates in both 1999 and 2003 compared to lower income neighbourhoods. There was, however, no significant difference between high and lower income neighbourhoods in terms of 1999 violent crime rates.

Background

This study is among the first of its kind conducted by Statistics Canada to examine crime data using Geographic Information System (GIS) technology.¹ The study, funded by the National Crime Prevention Centre at Public Safety and Emergency Preparedness Canada, examines crime patterns in the City of Regina in 2001, as well as changes in neighbourhood crime between 1999 and 2003. Results lend support to the notion that crime is not randomly distributed within cities but is associated with the distribution of other factors related to the population and land-uses of the city.

A recognition that crime is not evenly dispersed across cities, but is often concentrated within particular areas has been the focus of ecological studies of crime since the 1940s. This study uses socio-economic data from the most recent Census of Population (2001), the 1999, 2001 and 2003 Incident-based Uniform Crime Reporting Survey (UCR2), 1999 and 2003 Small Area and Administrative data from tax filers and City of Regina zoning data to describe and explain spatial patterns of crime using social, economic and physical neighbourhood characteristics. This study follows its predecessors (see Fitzgerald et al 2004; Savoie et al 2006) by addressing the following questions about neighbourhood crime: How are police-reported crimes distributed across city neighbourhoods? Is the rate of crime in a neighbourhood associated with factors that are specific to that neighbourhood such as particular population, housing, land-use or socio-economic characteristics? The Regina study also examines how neighbourhood crime changes over time.

These questions are addressed through a combination of statistical analyses and maps. Crime maps are important tools for the development and implementation of crime reduction strategies, and are used in this report to provide a visual representation of areas of concentrated crime and characteristics related to that concentration.

It should be noted that this study makes use of police-reported data, which includes only those crimes that are reported to and substantiated by the police. Many factors can influence the police-reported crime rate, including the willingness of the public to report crimes to the police; reporting by police to the UCR Survey; and changes in legislation, policies or enforcement practices.

According to the 2004 General Social Survey (GSS) on Victimization, only 34% of incidents at the national level in Canada were reported to the police (Gannon and Mihorean 2005). Incidents of break and enter were most likely to be reported (54%), and sexual assaults least likely (8%). While population-based surveys such as the GSS collect information directly from individuals about their experiences of criminal victimization regardless of whether the crime was reported to the police, these data are currently not available at the sub-urban levels in Canada.

The Census of Population is conducted by Statistics Canada every 5 years, and most recently in 2001. In order to achieve the highest degree of compatibility between neighbourhood characteristics derived from the Census and crime information, the description and explanation of spatial patterns of crime in this study are based on police and Census data from the year 2001. For the comparison between neighbourhood crime in 1999 and 2003, the populations are based on Statistics Canada data on tax filers and their dependents.²

The focus of this study is to examine factors related to the geographic location of reported criminal incidents, and does not address issues related to the residential location of either offenders or victims. Consequently, conclusions cannot be drawn about the connection between the location of criminal incidents and the residences of either accused individuals or victims, with the exception of household crimes such as Break-ins and property damage.

Findings

Regina in context

In 2001, the Regina Census Metropolitan Area (CMA), with a population of 192,800, ranked eighteenth in terms of size among the 25 CMAs in Canada.³ The 2001 population was down 0.4% from 1996 (193,652), making Regina one of only six CMAs to record population decreases over this time period. In 2001, the Regina CMA represented approximately 20% of the population of the province of Saskatchewan.

The City of Regina, which is the focus of this study, falls within the larger CMA boundary and encompasses 95 neighbourhoods or Neighbourhood Service Areas (NSAs) (see definition in text box entitled Neighbourhood Service Areas). The population of the study area in 2001 was 175,605. The area is served entirely by the Regina Police Service, which employed a force of 315 officers and 128 civilian employees in 2001.

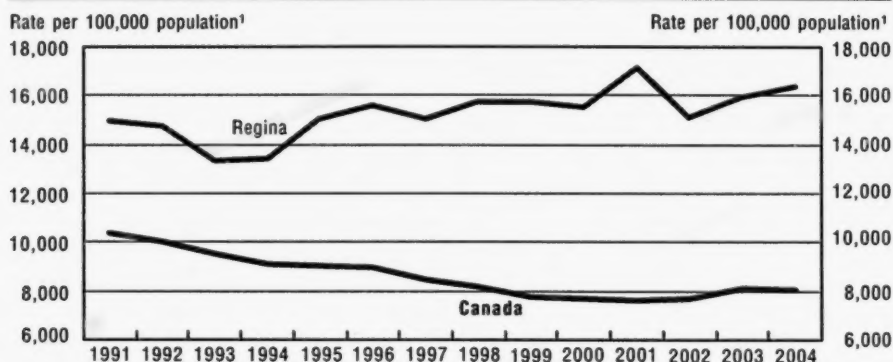
Zoning in Regina is composed of roughly 32% single-family, 25% multiple-family and other types of residential areas; 9% commercial; 2% industrial; and, 16% parks and recreation areas. The remaining 16% consists of institutional, transportation and other unique zoning areas.

The CMA of Regina has reported the highest crime rate in Canada for nine of the past ten years. In 2001, Regina's crime rate was 26% higher than the next highest CMA, Saskatoon. Chart 1 compares Regina's crime rate to the overall rate in Canada from 1991 to 2004. The overall Canadian crime rate generally declined throughout the 1990s before experiencing a 6% increase in 2003. In contrast, the crime rate in Regina generally increased throughout this period, with the exception of sizeable declines in 1993, 1997 and 2002.

Categories of offences considered in this study include: violent, property, drug, prostitution, offensive weapons, and gaming and betting offences. Impaired driving and harassing phone calls are excluded from the analysis because they generally have no useful address attached. Similarly, offences against the administration of justice, such as bail violations and failure to appear in court, would be mapped to a courthouse thus artificially inflating the crime rate in that area. As a result, offences against the administration of justice are also excluded from this analysis.

In 2001, the Regina Police Service reported over 26,000 relevant incidents, the vast majority of which were property crimes (85%), followed by violent crimes (13%), and other offences (2%) including prostitution, drugs, offensive weapons and gaming and betting. These results are similar to the distribution of offences in Canada overall in 2001 (79%, 17 % and 4% respectively), as well as the results reported by other police services in Western Canada including Calgary, Edmonton and Winnipeg.

Chart 1

Crime rate, Regina and Canada, 1991 to 2004

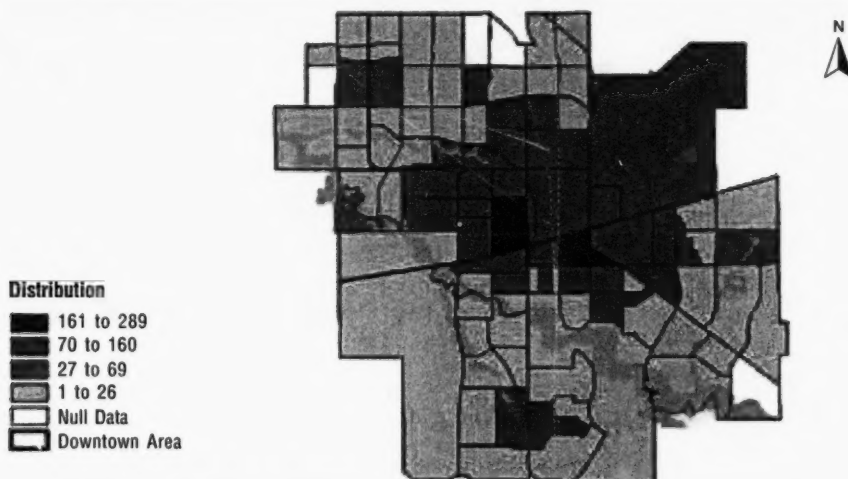
1. Rates based on count of total *Criminal Code* incidents, excluding traffic offences.

Sources: Statistics Canada, Canadian Centre for Justice Statistics, Uniform Crime Reporting Survey, 1991 to 2004 and Population estimates, Demography Division.

How is crime distributed across Regina neighbourhoods?

In 2001, incidents were reported in 93 of the 95 Neighbourhood Service Areas (NSAs) in Regina. These incidents were not evenly distributed across the city however, but rather clustered in certain areas. Map 1 and Map 2 show spatial distributions by NSAs for violent and property crimes, where dark blue represents the highest crime NSAs.⁴ About 30% of reported violent crime incidents in 2001 occurred in 5% of NSAs, and 30% of reported property crime incidents occurred in 12% of NSAs.⁵

Map 1

Distribution of violent crime incidents by Neighbourhood Service Area, Regina, 2001

Based on 3,193 violent crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 2

Distribution of property crime incidents by Neighbourhood Service Area, Regina, 2001

Based on 20,468 property crime incidents.

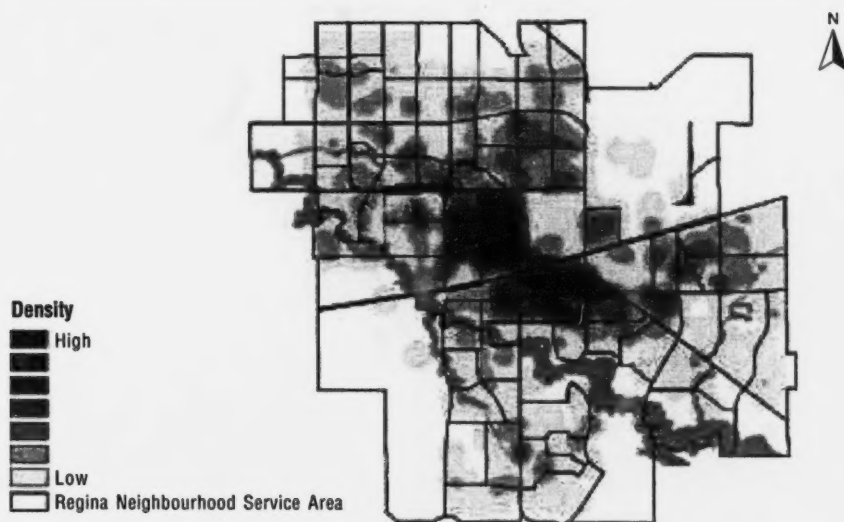
Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

The concentration of crime within cities in relatively few areas has been noted in other studies (Sherman, Gartin and Buerger 1989; Brantingham and Brantingham 1982; Fitzgerald et al. 2004). In Regina, much of the reported crime in 2001 was clustered in neighbourhoods that are in the downtown and north central areas, located near the centre of the city.

One way of examining these clusters of crime is by displaying them on kernel density maps. The areas with the highest densities of crime are called "hot spots" and appear on these maps as the dark blue zones. The areas with the lowest densities of crime appear in yellow. Map 3 and Map 4 show "hot spots" for violent and property crime in Regina in 2001.

Map 3

Kernel density distribution of violent crime incidents, Regina, 2001



Based on 3,193 violent crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 4

Kernel density distribution of property crime incidents, Regina, 2001



Based on 20,468 property crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

The first map shows that the areas with the highest relative densities of violent crime are located in the downtown and north central neighbourhoods. These neighbourhoods are separated by a series of train tracks which act as a physical barrier between them and the rest of the city.

The next map shows that the relative density of property crime in Regina is high in the same downtown and north central neighbourhoods. However property crime is more dispersed than violent crime, with a number of smaller hot spots appearing throughout the city and mostly near shopping centres. Maps showing the location of hot spots within the City for selected individual offence types are shown in Appendix A.

While Map 3 and Map 4 show the relative distribution of crimes in Regina, they do not take population into consideration. It is important to look at crime rates in order to make comparisons between geographic areas with different populations. Normally crime rates are expressed as a number of crimes per 100,000 residential population. This is adequate for large geographic areas such as cities and provinces; however, when we look at smaller areas, such as neighbourhoods, problems arise. Often crime will be concentrated in the downtown areas of a city, where there is little residential population but a large number of people coming into the area to work or pursue leisure activities. As a result, using only the residential population in the calculation of crime rates means that much of the population at risk of being a victim of crime is neglected and crime rates are artificially inflated because of the small residential populations being used. Since population counts for people in search of leisure activities are not available, the "population at risk"⁶ is defined as the residential population plus the population who come into the area to work. These variables are available from the Census. Table 1 compares results for rates based on residential population and population at risk in Regina neighbourhoods. Map 5 and Map 6 illustrate the importance of taking population into consideration. When population at risk is included, the hot spot for violent crime becomes more concentrated in the city centre, while property crime hot spots become more concentrated around the city's shopping areas.

Table 1

Count and rate of police-reported crime incidents in Regina neighbourhoods, 2001

Offences	Count of incidents ¹			
	Total all NSAs	NSA average	NSA minimum	NSA maximum
Total incidents³	24,235	255	0	1,162
Total violent incidents ³	3,193	34	0	259
Total property incidents ³	20,468	215	0	794
Drug incidents ³	173	2	0	35
Other ^{3,4}	401	4	0	74
Selected offences				
Arson ⁵	76	0	0	2
Assault level 1 ⁵	1,387	15	0	90
Breaking and entering ⁵	3,775	40	0	189
Car theft ⁵	3,782	40	0	136
Drug incidents ⁵	225	2	0	39
Homicide ⁶ and assault 2 and 3 ⁵	787	8	0	81
Mischief ⁵	3,312	35	0	136
Prostitution ⁵	75	1	0	34
Robbery ⁵	366	4	0	35
All sexual offences ^{5,7}	173	2	0	17
Shoplifting ⁵	892	9	0	115
Theft under (without car theft) ⁵	13,697	144	0	786
Theft over (without car theft) ⁵	837	9	0	43
Rate of incidents per 1,000 residential population²				
Offences	NSA average	NSA minimum	NSA maximum	
Total incidents³	180	22	2,631	
Total violent incidents ³	24	0	286	
Total property incidents ³	152	22	2,298	
Drug incidents ³	1	0	24	
Other ^{3,4}	3	0	35	
Selected offences				
Arson ⁵	0	0	1	
Assault level 1 ⁵	10	0	115	
Breaking and entering ⁵	27	3	393	
Car theft ⁵	26	1	341	
Drug incidents ⁵	2	0	24	
Homicide ⁶ and assault 2 and 3 ⁵	6	0	115	
Mischief ⁵	23	3	250	
Prostitution ⁵	0	0	20	
Robbery ⁵	3	0	34	
All sexual offences ^{5,7}	1	0	16	
Shoplifting ⁵	9	0	183	
Theft under (without car theft) ⁵	110	18	1,897	
Theft over (without car theft) ⁵	6	0	107	

Table 1 – concluded

Count and rate of police-reported crime incidents in Regina neighbourhoods, 2001

Offences	Rate of incidents per 1,000 residential and employed population ²		
	NSA average	NSA minimum	NSA maximum
Total incidents ³	101	20	328
Total violent incidents ³	14	0	96
Total property incidents ³	85	20	245
Drug incidents ³	1	0	8
Other ^{3,4}	2	0	26
Selected offences			
Arson ⁵	0	0	1
Assault level 1 ⁵	6	0	39
Breaking and entering ⁵	16	2	66
Car theft ⁵	16	1	48
Drug incidents ⁵	1	0	9
Homicide ⁶ and assault 2 and 3 ⁵	3	0	37
Mischief ⁵	14	2	48
Prostitution ⁵	0	0	16
Robbery ⁵	1	0	10
All sexual offences ^{5,7}	1	0	7
Shoplifting ⁵	4	0	72
Theft under (without car theft) ⁵	55	16	171
Theft over (without car theft) ⁵	3	0	19

1. Total count based on 95 Neighbourhood Service Areas (NSAs).
2. Rate based on the 87 NSAs where the total residential population was over 250 people.
3. Includes most serious violation in each incident only.
4. Includes Prostitution, Offensive Weapons, Gaming and Betting and other Residual *Criminal Code* offences.
5. Includes all recorded violations in each incident.
6. Includes Attempted Murder.
7. Includes Sexual Assault (levels 1-3) and other sexual violations.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 5

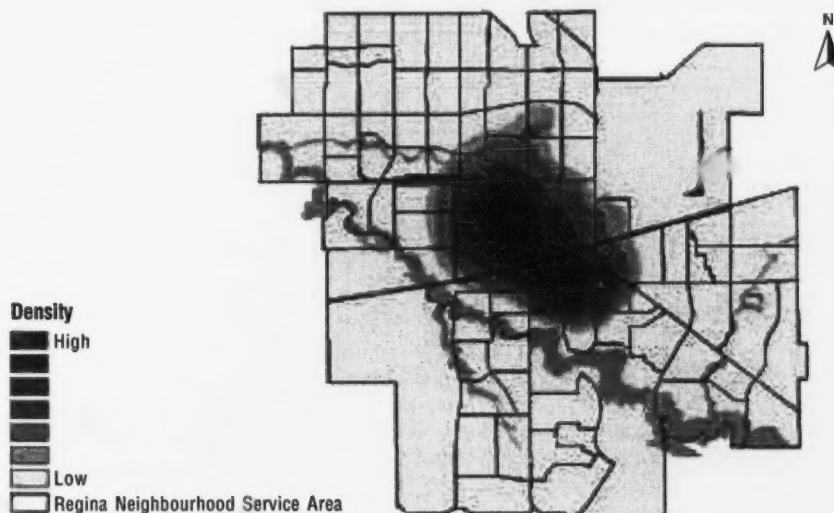
Kernel density distribution of property crime incidents and population at risk (combined residential and employed population), Regina, 2001

Based on 20,468 property crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 6

Kernel density distribution of violent crime incidents and population at risk (combined residential and employed population), Regina, 2001



Based on 3,193 violent crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Neighbourhood characteristics and crime within neighbourhoods⁷

Since the 1940s numerous studies (Shaw and McKay 1942) have documented the relationship between neighbourhood characteristics and rates of crime. These studies however, have differed with respect to their emphasis on the importance of factors such as low income, residential mobility, ethno-cultural composition, opportunities for criminal behaviour, collective efficacy (or the level of trust and reciprocity in a neighbourhood), and social disorganization (or a decrease in the influence of social rules over behaviour) (Cohen and Felson 1979; Brantingham and Brantingham 1982; Roncek and Maier 1991; Sampson and Lauritsen 1994; Sampson et al. 1997; Oberwittler in press).

This section explores the relationship between many of these factors and 2001 rates of violent and property crime within Regina Neighbourhood Service Areas (NSAs). The analysis makes use of total violent and property crime rates rather than rates for individual offence types to maximize the number of incidents being considered. The analysis is based on Neighbourhood Service Areas with residential populations greater than 250 people. Statistics Canada suppresses income data for geographies below this level for reasons of confidentiality and data quality.⁸ As a result, only 87 of the 95 Neighbourhood Service Areas are included.

Characteristics considered in this analysis have been derived from the 2001 Census and City of Regina zoning data and are outlined in the Description of variables section.

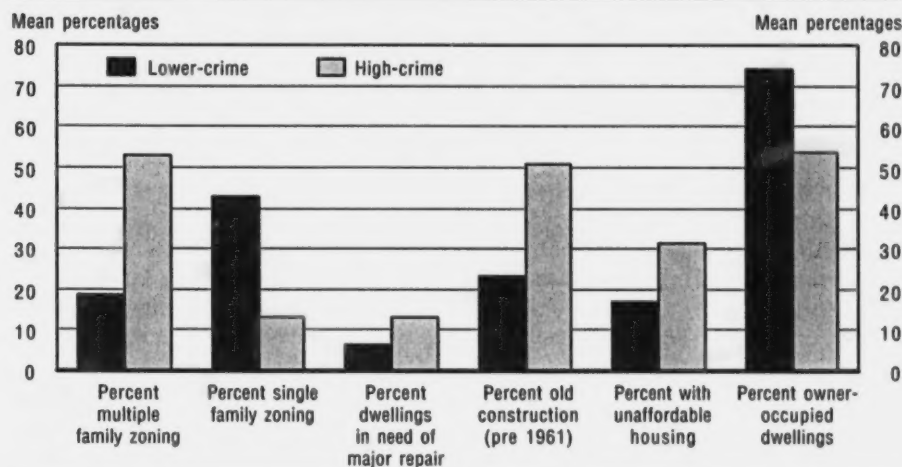
Descriptive results: a comparison of high- and lower-crime neighbourhoods

The relationship between violent and property crime rates and selected neighbourhood characteristics is examined by dividing the 87 Neighbourhood Service Areas (NSAs) into two groups for each crime type. The first group contains NSAs falling into the highest 25% of property and violent crime rates, and the second group contains the remaining 75% of NSAs.⁹

Before controlling for other factors, significant differences can be seen between high and lower crime neighbourhoods when examining selected neighbourhood characteristics. For instance, neighbourhoods with the highest rates of violent crime had significantly greater proportions of multiple-family residential zoning (53% and 18%, respectively); and lower levels of single-family zoning (13% and 42%, respectively) (Chart 2). On average, a greater proportion of housing in high violent crime rate areas was in need of major repairs (13% and 6%, respectively) and was older, built before 1961 (51% and 23%, respectively). There were also greater proportions of unaffordable housing represented by households spending more than 30% of their income on shelter (31% and 17%, respectively) and a smaller proportion of owner-occupied dwellings (54% and 74% respectively). These differences in land-use and housing characteristics were similar for property crime (Chart 3).

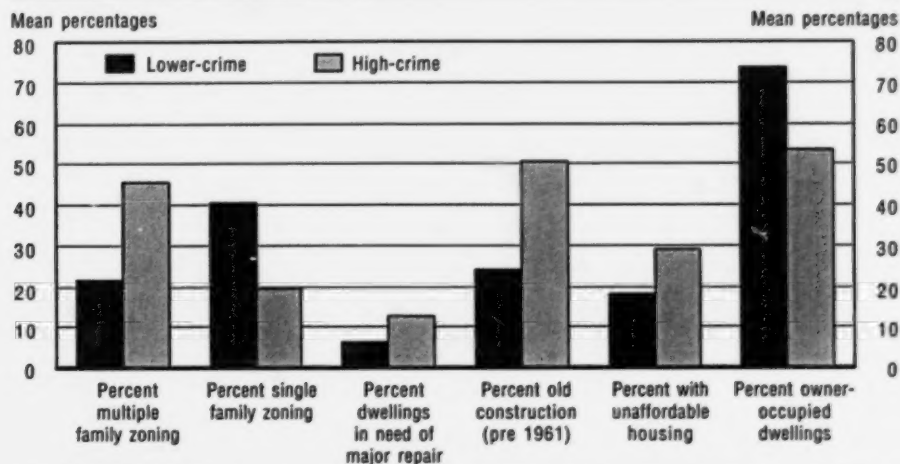
Chart 2

Land-use and housing characteristics in neighbourhoods with high and lower rates of violent crime, Regina, 2001



Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

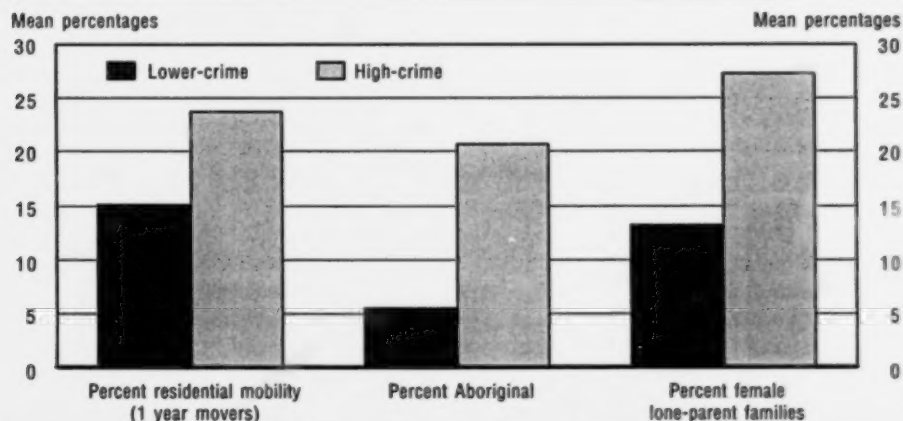
Chart 3

Land-use and housing characteristics in neighbourhoods with high and lower rates of property crime, Regina, 2001

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

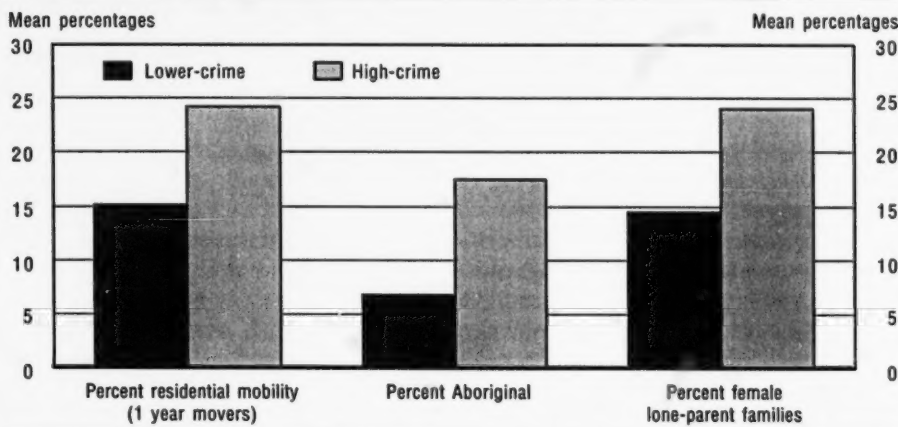
Differences between high-crime and lower crime neighbourhoods are also seen among population characteristics. For instance, Chart 4 shows that the NSAs with the highest violent crime rates had significantly greater percentages of residential mobility, or people who did not reside at the same address one year prior to the 2001 Census, compared to lower violent crime NSAs (24% and 15%, respectively). The highest violent crime rate NSAs also had greater percentages of Aboriginal residents (21% and 6%, respectively), and greater percentages of female lone-parent families (27% and 13%, respectively) than did their lower violent crime rate counterparts. Similar differences were found with respect to property crimes (Chart 5).

Chart 4

Population characteristics in neighbourhoods with high and lower rates of violent crime, Regina, 2001

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

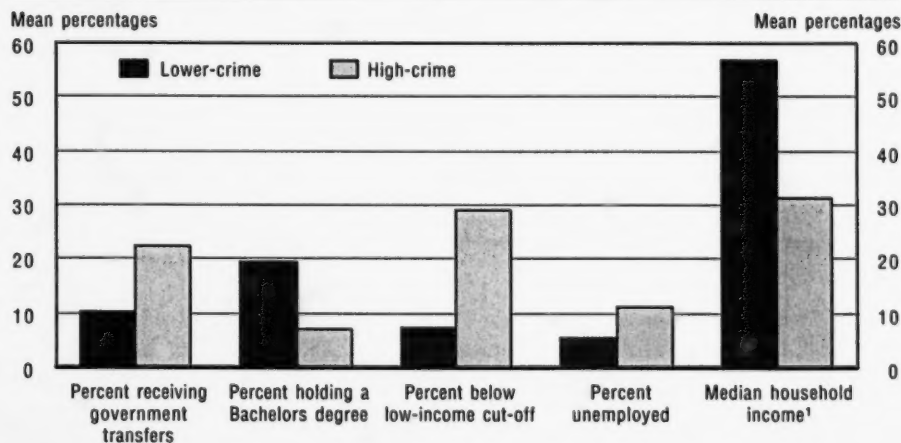
Chart 5

Population characteristics in neighbourhoods with high and lower rates of property crime, Regina, 2001

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Finally, Chart 6 points to the presence of concentrated socio-economic disadvantage in higher violent crime rate neighbourhoods, evidenced by significantly greater percentages of population receiving government transfers (22% and 10%, respectively), with incomes below the low income cut-off (29% and 7%, respectively) and unemployed (11% and 5%, respectively). In addition, these neighbourhoods have significantly lower median household incomes when compared to neighbourhoods with lower violent crime rates (\$31,000 and \$56,000, respectively) and lower percentages of the population holding a Bachelors degree (7% and 20% respectively). Chart 7 indicates similar results for property crime rates.

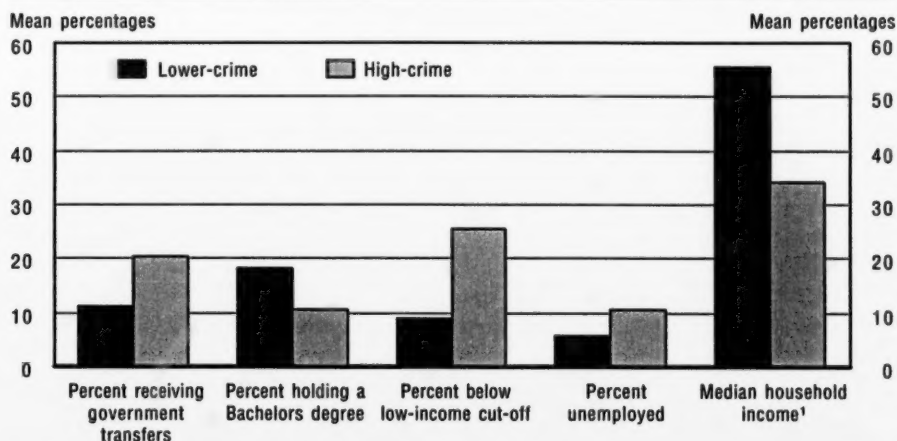
Chart 6

Socio-economic characteristics in neighbourhoods with high and lower rates of violent crime, Regina, 2001

1. Median household income in \$1,000s.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Chart 7

Socio-economic characteristics in neighbourhoods with high and lower rates of property crime, Regina, 2001

1. Median household income in \$1,000s.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

There were, however, no significant neighbourhood differences for some of the factors that were analyzed, including the proportion of males in the high-risk age group (15-to-24 years) and the proportion of older adults aged 64 and over.

Multivariate results

As illustrated already, neighbourhood characteristics are associated with both violent and property crime rates when examined individually. However, examining these characteristics together helps control for the effects of the other variables at the same time. Multivariate analysis is used to assess the relative contribution of neighbourhood characteristics to the explanation of crime, after taking other factors into account.¹⁰

Neighbourhood characteristic variables were standardized to have a mean of 0 and a standard deviation of 1 (z-score) and were regressed separately on violent and property crime rates. In selecting variables to be included in the regression models multicollinearity is a consideration. Multicollinearity is a situation where many of the independent variables are highly correlated with each other, meaning that they communicate much the same information. This is the result of strong links between many of the structural factors that are individually linked to crime (Land et al. 1990).

When multicollinearity exists in a model, the results of that model may be distorted.¹¹ In order to avoid this problem, certain highly correlated variables must be removed. Interdependence between variables can be determined through an examination of the relationship between two variables at a time (bivariate correlations), or through examining how multiple variables interact together. This study makes use of Variance Inflation Factors (VIF) to measure the multicollinearity between all of the independent variables in the regression models. A VIF over 10 is indicative of

potential multicollinearity problems in a regression model, and as a result any variables with a VIF of 5 or above have been removed (Montgomery, Peck and Vinin, 2001).

Results of the final regression models for violent and property crime rates appear in Table 2 and Table 3 and include the VIFs for each variable. The R-squared values indicate that the explanatory variables included in the models account for 74% of the variation in violent crime rates and 59% of the variation in property crime rates. The estimated regression coefficients (b) provide an indication of the relative contribution of each variable after controlling for the other variables in the model.

Table 2

OLS-multiple (Ordinary least squares) regression model for violent crime rates, Regina neighbourhoods 2001

Neighbourhood characteristics	Violent crime rate	
	Unstandardized regression coefficient (b)	Variance inflation factor
Median household income	-0.99***	4.62
Proportion of population renting home	0.36**	3.62
Proportion of population holding a bachelors degree	-0.23**	1.51
Proportion of males aged 15 to 24	0.15*	1.08
R-squared	0.74	...

... not applicable

* p<0.05

** p<0.01

*** p<0.001

Note: Ordinary least squares (OLS) regression is used to examine the distribution of violent and property crime rates as a function of the set of explanatory factors.

Sources: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001 and 2001 Census; City of Regina, 2005 Zoning data.

Table 3

OLS-multiple (Ordinary least squares) regression model for property crime rates, Regina neighbourhoods, 2001

Neighbourhood characteristics	Property crime rate	
	Unstandardized regression coefficient (b)	Variance inflation factor
Proportion of occupied dwellings built in 1960 or before	0.35***	1.72
Proportion of population holding a Bachelors degree	-0.35***	1.34
Proportion of neighbourhood population in private households with low income	0.32**	1.97
Proportion of males aged 15 to 24 years	0.20**	1.05
Neighbourhoods with between 20% and 40% commercial zoning	0.15*	1.05
R-squared	0.59	...

... not applicable

* p<0.05

** p<0.01

*** p<0.001

Note: Ordinary least squares (OLS) regression is used to examine the distribution of violent and property crime rates as a function of the set of explanatory factors.

Sources: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001 and 2001 Census; City of Regina, 2005 Zoning data.

The results of the regression on violent crime rates indicate that income makes the largest relative contribution to the explanation of violent crime ($b=-0.99$), holding all other explanatory variables constant. The negative b -value indicates an inverse relationship, meaning that as the median household income in a neighbourhood decreases, the violent crime rate increases. After income, the next largest relative contribution is made by the proportion of the population renting their home ($b=0.36$). As the proportion of the population renting their home increases, so does the violent crime rate.

Separate independent contributions to violent crime rates were made by a decrease in the proportion of the population holding a Bachelors degree ($b=0.23$), and an increase in the proportion of males aged 15 to 24 in a neighbourhood's population ($b=0.15$).

Results of the property crime model indicate that many of the factors that influence a neighbourhood's property crime rate are similar to those that influence its violent crime rate. Both crime types are influenced by income, education, housing conditions, and the proportion of young males in a neighbourhood. However, property crime rates are also associated with the proportion of commercial zoning in a neighbourhood. The largest relative contributions to the explanation of property crime were made by the proportion of older housing ($b=0.35$) and the proportion of the population holding a Bachelor's degree ($b=-0.35$). Housing and education are followed in importance by the relative contribution of income, as indicated by the proportion of the neighbourhood's population in private households with low income ($b=0.32$). Smaller, but significant, contributions to an increase in property crime rates, after adjusting for other variables, include an increase in the proportion of young males ($b=0.20$) and commercial zoning accounting for 20% to 40% of a neighbourhood's total area ($b=0.15$).

Spatial dependence in the data is the idea that the location where a neighbourhood is situated has an effect on its crime rate. This could be a direct effect of the crime rate in adjacent or nearby neighbourhoods. Spatial autocorrelation occurs when the spatial dependence in the data is not accounted for by the explanatory variables in the model. If it is detected in the error terms of the model then a spatial lag term must be added to compensate for its effects. The final regression models for Regina were tested for spatial autocorrelation but none was detected.¹² As a result, a spatial model was not required (see definition in text box entitled Spatial modelling).

Spatial modelling

Data that are measured in space, such as the geo-coding of crime incidents, are often affected by their location. If observations adjacent in space are affected by the same location properties, the observations will not be independent of one another. This lack of independence must be accounted for in the data analysis to produce accurate, unbiased results. This is accomplished through spatial modelling of the data and is important for any dataset where there is a potential effect of location.

It is known that crime is not evenly distributed across cities and that it is concentrated in particular areas. This is an initial indication that there might be a location effect in crime data and can be seen by examining a map of crime density in city neighbourhoods. There could be a positive effect where areas with high crime rates are surrounded by other areas with high crime rates and areas with low crime rates are adjacent to other areas with low crime rates. A negative location effect results from areas of low crime being surrounded by areas with high crime and vice versa. This is an indication of some sort of spatial structure or spatial dependence in the data, signifying that the neighbourhoods have an influence on each other.

How do we test for spatial dependence?

The formal test for the presence of spatial dependence is Moran's I statistic, which tests if the data are randomly distributed over the study area. For crime rates, spatial randomness implies that 'hot-spots' of crime are distributed randomly over the city neighbourhoods and they have no effect on the adjacent regions. Thus, there is no spill-over or diffusion of crime between neighbourhoods. The significance of Moran's I statistic is determined by a random permutation approach, where a significant result indicates that there is spatial dependence in the data.

How are neighbours defined?

For spatial modelling, a definition of what constitutes neighbouring locations needs to be specified. In this analysis a contiguity structure is used to define regions as neighbours of each other. The contiguity structure includes all common points, either borders or vertices that touch between the neighbourhood boundaries. The neighbourhood structure defines which locations have a potential influence on each other, the neighbours, and rules out any effect of regions that are not neighbours.

What is spatial autocorrelation and how do we account for it?

Spatial autocorrelation is the presence of spatial effects in the residuals or error terms from a regression analysis. The presence of spatial autocorrelation is again tested using Moran's I statistic computed from the residuals. If Moran's I indicates that spatial autocorrelation is present, then the basic regression assumptions have been violated and the results may be biased. In this case, the explanatory variables or neighbourhood characteristics do not explain all of the spatial structure in the data and there is some lingering effect of the neighbouring locations. This location effect must be accounted for in the multivariate model for the accurate estimation of the regression coefficients and their associated variances.

When spatial autocorrelation is detected in the residuals from a regression analysis a spatial model is fit to the data instead of the standard ordinary least squares model. The spatial model provides the same analysis of the neighbourhood characteristics as predictors of crime, but adjusts for the spatial effects. To do this, an extra term called the spatial lag is added to the model representing the average crime rate from all neighbouring locations, and the spatial effects are accounted for in the model. The results from this analysis are essentially the same as other multivariate regression analyses. The regression coefficients for the neighbourhood characteristics represent their relative contribution to the prediction of crime. The spatial lag regression coefficient, however, does not provide a direct explanation in the same way. This parameter in part represents the effect of neighbouring locations but also accounts for some of the measurement error in defining the neighbourhoods. Thus, the spatial lag cannot be interpreted directly; it is only retained in the model to make the other results accurate.

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Regina's Aboriginal population

Regina has a relatively high aboriginal population as a proportion of its total population when compared to other Canadian cities. Aboriginal people make up 8.3% of the population of the CMA of Regina, making it the CMA with the third highest proportion of Aboriginal people, after Saskatoon and Winnipeg (9.1% and 8.4% respectively).

A recent study on Aboriginal conditions in Canadian cities over the past 20 years indicated that overall, Aboriginal people living in metropolitan areas in Canada were doing better in 2001 than 20 years previously in terms of acquiring knowledge and standard of living (Siggner and Costa 2005). One of the exceptions to this trend is Regina, where the gap in school attendance between Aboriginal and non-Aboriginal youth widened between 1981 and 2001 and the Aboriginal employment rate dropped. Results of the 2004 GSS show that Aboriginal people reported the highest rates of violent victimization compared to other minority populations and the non-Aboriginal population (Gannon and Mihorean 2005). Those who self-identified as being Aboriginal were three times more likely than the non-Aboriginal population to be the victim of a violent incident (319 people aged 15 and over per 1,000 compared to 101 per 1,000). Aboriginal women reported being particularly at risk, with rates of violent victimization that were 3.5 times higher than rates for non-Aboriginal women, while rates for Aboriginal men were 2.7 times higher than those for non-Aboriginal men.

When the proportion of Aboriginal people in a neighbourhood is modelled with crime rates, this variable alone explains 34% of the variation in property crime rates and 53% of the variation of violent crime rates in neighbourhood. This raises the question of what characteristics are associated with neighbourhoods with high Aboriginal populations. Neighbourhoods with higher proportions of Aboriginal people also tend to have high proportions of households in low income situations, high proportion of population receiving government transfers, low education rates, high unemployment, housing in need of repair, high proportion of multiple-family dwellings, high proportion of renters and a higher proportion of recent movers. Many of these factors have been shown to be connected to higher neighbourhood rates of crime.

Further exploration in upcoming analyses will expand our understanding of the socio-economic conditions in neighbourhoods with high Aboriginal populations in several Canadian cities in order to better identify conditions and points of intervention to help reduce crime and victimization among this population.

Exploration of changes in neighbourhood crime and characteristics over time

Explorations of changes over time in neighbourhood crime levels must take into account changes in neighbourhood populations and characteristics. This study focuses on a five-year time period and makes use of geocoded crime data from 1999 and 2003. Because these are not Census years, data on neighbourhood populations and characteristics are not available from the Census. However, household income was shown to be an important predictor of both violent and property crime in Regina and limited data on income are available through the Small Area and Administrative Data (SAAD) division of Statistics Canada. SAAD was able to provide neighbourhood level population counts as well as information on income groupings and median income, as derived from the annual tax file received from the Canada Revenue Agency. This file contains information on taxfilers and their dependents and represents approximately 96% of the Canadian population. As a result of using non-Census population data, there are limitations to the analysis that can be completed in this section. First, population figures used in this section are referring to residential populations only. Second, differences in the way population figures are derived from the tax data and the Census data have resulted in slightly different population figures from each source at the Neighbourhood Service Area (NSA) level. In order to minimize these differences, NSAs have been grouped together in this section of the report, leaving 29 combined neighbourhoods for analysis (Table 4). Finally, population data were not available at a sufficiently detailed geographic level to allow for the production of dual kernel density maps. Therefore, all maps in this section are single kernel density maps and do not take population into account.

Table 4

Concordance between Neighbourhood Service Areas (NSAs) and combined neighbourhoods for change over time analysis

Combined neighbourhood	NSA name
Al Ritchie	AL RITCHIE 1 AL RITCHIE 2 AL RITCHIE 3 AL RITCHIE 4
Albert Park	ALBERT PK 1 ALBERT PK 2 ALBERT PK 3
Arcola	ARCOLA 1 ARCOLA 2 ARCOLA 3 ARCOLA 4 ARCOLA 5 ARCOLA 6 ARCOLA 7
Argyle Park	ARGYLE PK 1 ARGYLE PK 2
Boothill	BOOTHILL
Cathedral	CATHEDRAL 1 CATHEDRAL 2 CATHEDRAL 3 CATHEDRAL 4
Core	CORE 1 CORE 2
Coronation Park	CORONATION PK 1 CORONATION PK 2 CORONATION PK 3 CORONATION PK 4
Dieppe	DIEPPE
Downtown	DOWNTOWN
Eastview	EASTVIEW
Gladmer Park	GLADMER PK
Glen Elm	GLEN ELM 1 GLEN ELM 2
Glencairn	GLENCAIRN 1 GLENCAIRN 2 GLENCAIRN 3 GLENCAIRN 4
Hillisdale	HILLSDALE 1 HILLSDALE 2
Lakeview	LAKEVIEW 1 LAKEVIEW 2 LAKEVIEW 3 LAKEVIEW 4 LAKEVIEW 5
McNab	MCNAB
Normanview	NORMANVIEW 1 NORMANVIEW 2 NORMANVIEW W 1 NORMANVIEW W 2

Table 4 – concluded

Concordance between Neighbourhood Service Areas (NSAs) and combined neighbourhoods for change over time analysis

Combined neighbourhood	NSA name
North Central	NORTH CENTRAL 1 NORTH CENTRAL 2 NORTH CENTRAL 3 NORTH CENTRAL 4 NORTH CENTRAL 5 NORTH CENTRAL 6 NORTH CENTRAL 7
Northeast	NORTHEAST 1 NORTHEAST 2 NORTHEAST 3 NORTHEAST 4
Prairie View	PRAIRIE VIEW 1 PRAIRIE VIEW 2 PRAIRIE VIEW 3
Regent Park	REGENT PK 1 REGENT PK 2
Rosemont	ROSEMONT MR 1 ROSEMONT MR 2 ROSEMONT MR 3 ROSEMONT MR 4
Sherwood McCarthy	SHERWOOD MCCARTHY 1 SHERWOOD MCCARTHY 2
Transitional	TRANSITIONAL 1 TRANSITIONAL 2 TRANSITIONAL 3
Twin Lakes	TWIN LAKES 1 TWIN LAKES 2 TWIN LAKES 3 TWIN LAKES 4
Uplands	UPLANDS 1 UPLANDS 2 UPLANDS 3 UPLANDS 4
Walsh Acres	WALSH ACRES 1 WALSH ACRES 2 WALSH ACRES 3 WALSH ACRES 4
Whitmore Park	WHITMORE PK 1 WHITMORE PK 2

Source: Urban Planning Division, City of Regina, 2001.

The population of Regina dropped by 1% between the years 1999 and 2003. Population changes among the combined neighbourhoods ranged from a 10% decline in Glen Elm to an 18% increase in McNab. In their study of violent crime in Chicago between 1970 and 1990, Morenoff and Sampson (1997) found that neighbourhoods with high rates of homicide tend to experience drops in population as residents moved in search of safer neighbourhoods. An examination of population changes in Regina between 1999 and 2003 supports these findings. There are too few homicides in Regina to examine homicide rates by neighbourhood, but when violent crime rates are examined, nine neighbourhoods recorded violent crime rates in 1999 that were higher than the rate for Regina overall. Nearly all of these high violent

crime neighbourhoods also recorded declines in population between 1999 and 2003, while two recorded no change. However, the neighbourhood with the highest violent crime rate in 1999, Core, recorded a 3% increase in population over this time period.

Between 1999 and 2003, the mean violent crime rate of all neighbourhoods in Regina increased by 2.5% from a rate of 1,796 incidents per 100,000 population to 1,841 (Table 5). Changes in violent crime rates among the neighbourhoods ranged from a 32% decline in Cathedral (from 2,286 incidents per 100,000 residents in 1999 to 1,564 in 2003) to doubling in Boothill (from 354 incidents per 100,000 population in 1999 to 708 in 2003). Despite this increase, Boothill reported violent crime rates considerably lower than the mean in both years. Map 7 and Map 8 show that violent crime hotspots remained more or less in the same areas of the city over the 5-year time period.

Table 5

Violent crime, property crime and population changes, combined Regina neighbourhoods, 1999 and 2003

Combined neighbourhood	1999 population	2003 population	1999 violent rate	2003 violent rate	Percent change violent	1999 property rate	2003 property rate	Percent change property	1999	2003
									Proportion earning more than \$50,000 (in per- centage)	Proportion earning more than \$50,000 (in per- centage)
Al Ritchie	7,975	7,490	2,307.2	2,708.5	17.4	14,407.5	14,339.1	-0.5	5	9
Albert Park	11,030	11,050	634.6	462.4	-27.1	7,688.1	7,294.1	-5.1	22	26
Arcola	17,415	18,480	235.4	304.3	29.3	3,204.1	4,345.2	35.6	32	37
Argyle Park	4,260	3,990	868.5	774.6	-10.8	3,873.2	5,939.8	53.4	10	15
Boothill	2,825	2,980	354.0	708.0	100.0	6,761.1	4,698.0	-30.5	13	19
Cathedral	6,650	6,410	2,285.7	1,563.9	-31.6	13,248.1	14,539.8	9.7	16	22
Core	4,470	4,610	8,232.7	7,427.3	-9.8	25,234.9	26,724.5	5.9	4	6
Coronation Park	6,805	6,610	2,057.3	2,307.1	12.1	12,814.1	15,748.9	22.9	7	10
Dieppe	1,890	1,810	846.6	1,058.2	25.0	3,650.8	4,254.1	16.5	11	17
Downtown	2,010	2,020	6,318.4	6,865.7	8.7	37,412.9	38,217.8	2.2	6	7
Eastview	1,835	1,780	3,160.8	2,670.3	-15.5	14,005.4	18,089.9	29.2	3	5
Gladmer Park	1,215	1,330	905.3	1,646.1	81.8	10,617.3	14,135.3	33.1	10	14
Glen Elm	3,345	3,000	1,405.1	1,524.7	8.5	12,825.1	15,466.7	20.6	6	9
Glencairn	12,865	13,090	831.7	948.3	14.0	4,967.0	5,530.9	11.4	11	18
Hillsdale	5,455	5,390	440.0	568.3	29.2	7,241.1	9,573.3	32.2	22	27
Lakeview	7,300	7,270	479.5	397.3	-17.1	6,986.3	7,359.0	5.3	22	30
McNab	1,230	1,450	1,463.4	1,382.1	-5.6	13,170.7	9,310.3	-29.3	8	10
Normanview	7,115	7,040	955.7	1,321.2	38.2	9,107.5	8,877.8	-2.5	13	18
North Central	11,430	10,780	8,066.5	7,445.3	-7.7	28,915.1	28,024.1	-3.1	3	5
Northeast	7,225	7,020	2,740.5	2,574.4	-6.1	17,494.8	18,433.0	5.4	5	7
Prairie View	6,485	6,480	431.8	431.8	0.0	4,965.3	5,185.2	4.4	23	29
Regent Park	3,015	2,760	1,160.9	1,625.2	40.0	7,230.5	9,529.0	31.8	7	11
Rosemont	8,735	8,760	1,121.9	1,270.7	13.3	10,211.8	9,212.3	-9.8	8	14
Sherwood McCarthy	6,705	6,270	596.6	790.5	32.5	5,026.1	5,614.0	11.7	12	19
Transitional	3,265	3,260	1,745.8	1,929.6	10.5	15,804.0	16,441.7	4.0	9	13
Twin Lakes	5,205	5,510	576.4	653.2	13.3	4,534.1	6,061.7	33.7	23	29
Uplands	5,760	5,560	694.4	763.9	10.0	6,076.4	6,241.0	2.7	14	20
Walsh Acres	7,465	7,540	495.6	716.2	44.5	3,616.9	7,537.4	108.4	22	28
Whitmore Park	6,525	6,400	674.3	536.4	-20.5	5,440.6	7,000.0	28.7	21	28
Total all neighbourhoods	177,505	176,140	1,713.8	1,728.7	0.9	10,054.4	10,738.6	6.8	15	20
Mean crime rates	1,796.1	1,840.5	2.5	10,914.9	11,852.6	8.6

... not applicable

Sources: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 1999 and 2003 and Small Area and Administrative Data Division, 1999 and 2003.

Map 7

Kernel density distribution of violent crime incidents, Regina, 1999

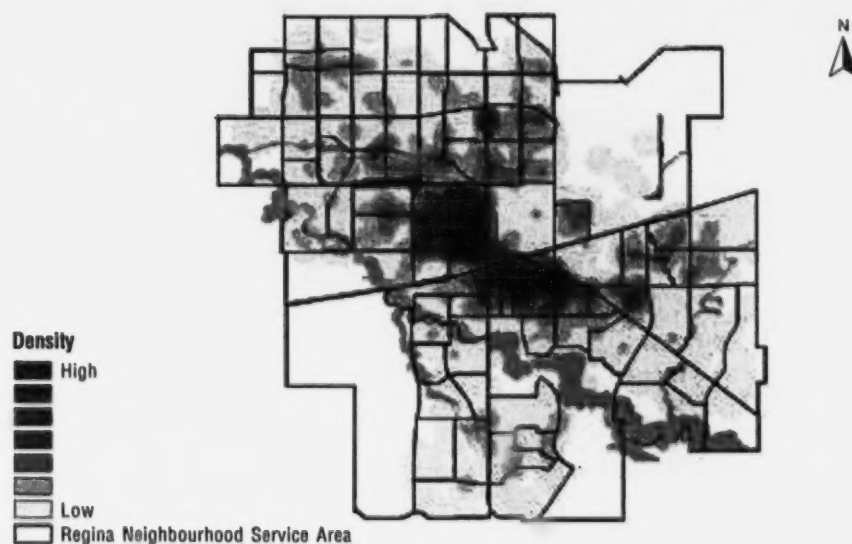


Based on 3,070 violent crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 1999.

Map 8

Kernel density distribution of violent crime incidents, Regina, 2003



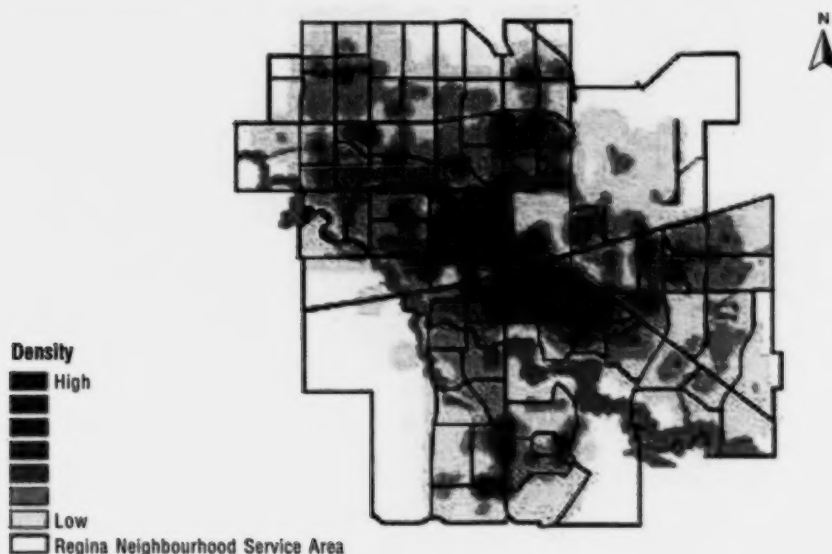
Based on 3,091 violent crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2003.

The mean property crime rate for neighbourhoods in Regina also increased (8.6%) over this time period, from 10,915 to 11,853 (Table 5). Despite recording the highest increase in violent crime rates between 1999 and 2003, Boothill reported the largest decrease in property crime rates of all the neighbourhoods (-31%). The largest increase was recorded by Walsh Acres (108%) where property crime rates remained well below the mean (3,617 in 1999 and 7,537 in 2003). Map 9 and Map 10 show that property crime hotspots remained relatively stable between 1999 and 2003. By 2003, a couple of new high-density hot spots can be seen in the city's North and East-most neighbourhoods. These areas recorded increases in both population and property crime rates over the 1999 to 2003 time period.

Map 9

Kernel density distribution of property crime incidents, Regina, 1999



Based on 18,151 property crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 1999.

Map 10

Kernel density distribution of property crime incidents, Regina, 2003

Based on 19,687 property crime incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2003.

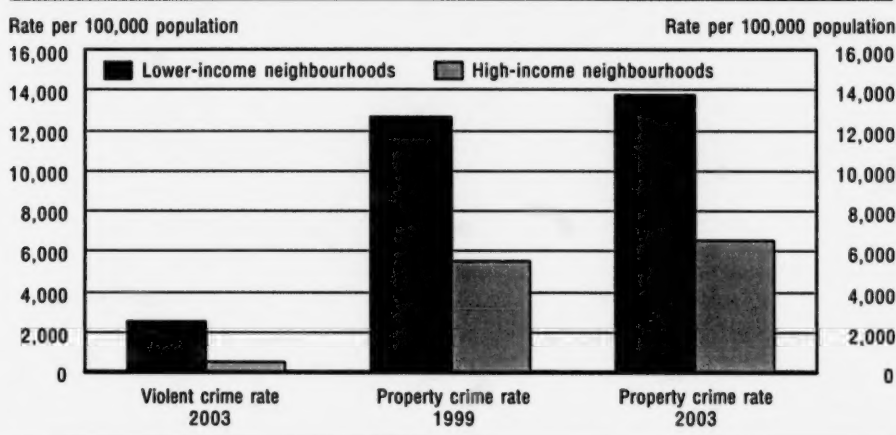
Multivariate analysis of crime rates and neighbourhood characteristics in 2001 indicated that income is a determinant of neighbourhood crime levels. While the same indicators of income (median household income and the proportion of private households with low income) were not available for 1999 and 2001, some data on personal income were available. In 1999, 15% of taxfilers in Regina reported earning \$50,000 or more.¹³ By 2003, 20% of taxfilers reported earning that much. In 1999 there were 9 neighbourhoods reporting the city average or above, and in 2003 there were 10 such neighbourhoods. In both years, only one neighbourhood with a high proportion of high earners recorded violent or property crime rates that were above the mean. Where neighbourhoods with the lowest proportion of high-earners are examined, the reverse also holds true.

To examine the relationship between neighbourhood crime rates and income over time the combined neighbourhoods are divided into two groups for each year. In order to remain consistent with the approach taken earlier in this report, the first group contains neighbourhoods with the highest 25% of high-earners,¹⁴ hereafter referred to as high-income neighbourhoods,¹⁵ the second group contains the remaining 75% of combined neighbourhoods, hereafter referred to as lower-income neighbourhoods.¹⁶ Without controlling for other factors, significant differences can be seen between high-income neighbourhoods and lower-income neighbourhoods.

For instance, Chart 8 shows that neighbourhoods that were high-income neighbourhoods in 1999 had significantly lower property crime rates compared to lower-income neighbourhoods (5,494 incidents per 100,000 population and 12,650 respectively). These high-income neighbourhoods also experienced significantly different violent and property crime rates in 2003 compared to lower-income

neighbourhoods (527 violent incidents per 100,000 population and 2,470 respectively; 5,494 property crime incidents per 100,000 population and 6,514 respectively). High-income neighbourhoods also tended to remain high-income neighbourhoods five-years later, as they recorded higher proportions of taxfilers earning \$50,000 or more in 2003 than did lower-income neighbourhoods (30% and 13% respectively).

Chart 8

Crime rates in high-income and lower-income neighbourhoods¹, Regina, 1999

1. Refers to combined neighbourhoods as detailed in Table 4.

Source : Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 1999, 2003.

Similar differences were found for high-income neighbourhoods in 2003. High-income neighbourhoods in 2003 were more likely to have lower violent and property crime rates in that year, as well as to have experienced lower property crime rates 5 years previously than were lower-crime neighbourhoods.

Though neighbourhoods that were considered high-income in either year had significantly different property crime rates in both years and significantly different violent crime rates in 2003, the difference in both years between groups in terms of 1999 violent crime rates was weakly significant.¹⁷

Another aspect of crime changes over time involves the composition of crime. Brantingham and Brantingham (1998) have adapted the location quotient used in regional planning to look at relative local economic activity for use in the analysis of crime. Crime location quotients (LQCs) offer a method of measuring the relative mix of different types of crimes for a particular area compared to the surrounding area. In this report, LQCs are used to compare the proportion of a certain type of crime in a combined neighbourhood to the proportion of that crime in Regina overall. For instance, a violent LQC of 1.00 in a particular neighbourhood indicates that the relative proportion of violent crime in that neighbourhood is the same as the relative proportion of violent crime for the city overall. Otherwise, the amount above or below 1.00 indicates the percentage above or below the normal trend in the city. The value in examining changes in LQC over time is that changes in a specific crime LQC indicate a change in the dominance of a particular type of crime, which may not be evident by looking at crime numbers and rates alone.

Table 5 compares violent crime counts, rates and LQCs for combined neighbourhoods in 1999 and 2003. In both 1999 and 2003, violent crime accounted for 14% of crime in Regina. The LQCs indicate that there were 6 neighbourhoods in 1999 and 7 in 2003 in which violent crime made up an even greater proportion of crime. In 1999 violent LQCs ranged from 1.54 in Core, indicating a proportion of violent crime that is 54% above the normal trend for the city, to 0.35 in Boothill, indicating a proportion of violent crime that is 65% lower than the normal trend for the city. In 2003, violent LQCs ranged from 1.56 in North Central to 0.37 in Lakeview.

Between 1999 and 2003, a number of neighbourhoods experienced changes in their violent LQCs, indicating that the dominance of violent crime in those areas was changing. Though Boothill reported the lowest proportion of violent crime of all neighbourhoods in 1999, it experienced the largest increase in its LQC over the next five years, from 0.35 to 0.91. This indicates that though Boothill continued to experience a lower proportion of violent crime than did the city overall, the proportion of crime it experienced that was violent had increased substantially.

Other notable increases in violent LQCs over the same time period occurred in three neighbourhoods, Al Ritchie, Regent Park and Downtown, that recorded LQCs below 1.00 in 1999, but by 2003 were recording LQCs above 1.00. In other words, these three neighbourhoods had lower proportions of violent crime than did the city overall in 1999, but by 2003 violent crime had become more dominant and made up a greater proportion of crime in those neighbourhoods than it did in the city overall.

Three neighbourhoods experienced the opposite phenomenon, violent LQCs that were above 1.00 in 1999 and fell to below 1.00 by 2003. Eastview, Argyle Park and Cathedral all reported such a decrease in violent LQCs over those five years, with Argyle Park recording the largest decline in violent LQCs of all neighbourhoods, from 1.27 in 1999 to 0.89 in 2003.

It is important to examine LQCs in combination with crime counts and crime rates, rather than on their own. This is highlighted in the case of Regent Park where the increasing dominance of violent crime in that neighbourhood, as evidenced by the increasing violent LQCs, is accompanied by relatively low violent crime rates in both 1999 and 2003. The changing composition in crime in this area may point to issues of interest to local stakeholders, including residents and police, as well as raises questions for further research. Dieppe similarly reported very low violent crime counts and rates, but violent LQCs that were among the highest in the city, indicating that while very little crime was occurring in this neighbourhood overall, a large portion of what did occur was violent.

Discussion

This study has made use of numerous data sources in conducting an analysis of the spatial distribution of crime in Regina, Saskatchewan. This study is the third of its kind undertaken by Statistics Canada. A combination of statistical analyses and crime mapping techniques were employed to examine how police-reported crimes are distributed across city neighbourhoods, how neighbourhood crime rates are associated with factors that are specific to that neighbourhood such as population, housing, land-use or socio-economic characteristics, and how neighbourhood crime rates change over time.

Results of this analysis support previous research that crime is not evenly distributed across city neighbourhoods. To the contrary, crime tends to be concentrated in neighbourhoods with particular population, housing and land-use characteristics. In Regina, violent crime is concentrated around the city's core, in neighbourhoods known as Downtown and North Central. Only 5% (5 out of 95) of neighbourhoods in Regina accounted for 30% of all violent incidents. Property crime in Regina shows a similar pattern of concentration around the city's core, but is accompanied by smaller hotspots throughout the city. These hotspots are generally located near the city's shopping centres. Because of this slightly greater dispersion through the city, 12% of neighbourhoods account for 30% of the city's property crime incidents.

Without controlling for other factors, significant differences are found to exist between high crime and lower crime neighbourhoods. These differences include characteristics specific to the population of the neighbourhoods, including residential mobility, family composition, and Aboriginal population. There are also differences between high crime and lower crime neighbourhoods in terms of land-use and housing characteristics, such as single family zoning, housing conditions, and unaffordable housing, as well as socio-economic conditions, including low income, unemployment, and education levels.

When highly correlated variables are removed and all other factors held constant, results of the multivariate analysis indicate that higher levels of crime occur in neighbourhoods with lower levels of income and education. Low levels of income and education are generally indicative of a high degree of socio-economic disadvantage. In a study by Boyle and Lipman, both family and neighbourhood socioeconomic disadvantage were found to be strong predictors of behavioural problems in children, including disobedience, interpersonal conflict, and rule violations (Boyle and Lipman 2002). Poverty has also been determined to be a predictor of more extreme delinquency in teenage boys, including breaking and entering and assault (Pagani et. Al 1999). Further, it has been argued that the association between disadvantage and crime is so strong that other factors that are generally seen as "symptoms" of high-crime neighbourhoods are actually attributable to socio-economic disadvantage (Sampson and Raudenbush 1999).

Neighbourhoods with higher proportions of males between the ages of 15 and 24 also experienced higher levels of crime than did neighbourhoods with lower proportions of these young males. This age group is known to represent the highest risk age group for offending and violent victimization. In particular, the violent victimization rate for Canadians aged 15 to 24 years was 1.5 to 1.9 times greater than the rate recorded for other age groups (Gannon and Mihorean 2005).

The multivariate analysis in this study indicates that issues related to housing also have an impact on levels of neighbourhood crime. Neighbourhoods with higher proportions of renters, as opposed to home-owners, tend to have higher rates of violent crime. Greater proportions of owner-occupied housing in a neighbourhood may increase residential stability, social involvement among neighbours and a collective commitment to the neighbourhood. Other studies have illustrated a strong correlation between low levels of social engagement and violent crime (Putnam 2001).

There is also a connection between housing conditions and property crime rates in a neighbourhood. Property crime rates tend to be higher in neighbourhoods with greater proportions of older housing (built in 1960 or before) than in neighbourhoods with more new housing. The importance of older housing likely lies in its high correlation with housing in need of major repair. This factor is an indication of lower community affiliation, a lower sense of community responsibility leading to a disconnection from identification with and interest in neighbours and neighbourhood (Sampson and Raudenbush 1999). Property crime rates are also connected to a neighbourhood's land-use patterns. Commercial zoning provides greater opportunity for certain property crimes, most notably theft of property and theft of and damage to motor vehicles.

An exploratory analysis of neighbourhood crime over the period from 1999 to 2003 indicated that both violent crime and property crime hotspots remained relatively stable. Preliminary analysis supports previous research indicating that neighbourhoods with high violent crime rates tend to experience drops in population. Building on earlier results that income levels in a neighbourhood act as a predictor of crime, the study further showed that high-income neighbourhoods had significantly lower property crime rates in both years and significantly lower violent crime rates in 2003. There was, however, no significant difference in either year between groups in terms of 1999 violent crime rates.

Limitations and opportunities

This study attempted to address a limitation identified in the first neighbourhood level crime analysis conducted by Statistics Canada, *Neighbourhood characteristics and the distribution of crime in Winnipeg* (Fitzgerald et al. 2004). That study pointed to an examination of changes in neighbourhood crime rates and associated characteristics over time as an area for further research. Change over time was examined in Regina from 1999 to 2003. Since these were non-Census years, data on neighbourhood populations and characteristics were not available through the Census. The Small Area and Administrative Data division of Statistics Canada was able to provide neighbourhood level population counts by age and sex as well as information on income groupings and median income, as derived from the annual taxfile received from the Canada Revenue Agency. The resulting analysis, therefore, was limited and did not include the same population, socio-demographic and housing variables as the more thorough analysis included for the 2001 Census year. An opportunity exists to revisit the sites of current geocoding analysis following the release of 2006 Census data in order to undertake a more detailed analysis of the changes in neighbourhood crime rates and associated characteristics over time.

Another limitation of this study involves the use of police-reported data, which includes only those crimes that are reported to and substantiated by the police. Many factors can influence the police-reported crime rate, including the willingness of the public to report crimes to the police; reporting by police to the UCR Survey; and changes in legislation, policies or enforcement practices. If victim data becomes available in the future at a level which would support geocoding, analysis should be undertaken to provide a more complete picture of neighbourhood crime.

Methodology

Description of variables

Crime variables

While selected individual offence types are displayed in tables and maps, analyses exploring the relationship between crime and neighbourhood characteristics are limited to the broad offence categories of violent and property crime to maximize the number of incidents being considered.

For this report, violent crime includes homicide, attempted murder, sexual assault, assault, violations resulting in the deprivation of freedom, robbery, extortion, criminal harassment, explosives causing death or bodily harm, uttering threats and other violent violations. Property crime includes arson, break and enter, theft under \$5,000, theft \$5,000 and over, possessing stolen goods, fraud and mischief.

2001 Census of Population variables

Population characteristic variables

The following Census variables describing different characteristics of the neighbourhood populations were included in the analysis:

- Percent of population receiving government transfer payments including; Employment Insurance; Old Age Security including Guaranteed Income Supplement and Spousal Allowance; Net Federal Supplements; Canada and Quebec Pension Plan benefits; Child Tax Benefit; New Brunswick, Quebec, Alberta and British Columbia Family Allowance; Goods and Services Tax Credit; Workers' Compensation; Social Assistance; and provincial/territorial Refundable Tax Credits.
- Percent of neighbourhood population aged 15 years and over holding a Bachelors degree.
- Percent of neighbourhood population in private households with low income in 2000. Low income refers to private households who spend 20% more of their disposable income than the average private household on food, shelter and clothing. Statistics Canada's low-income cut-offs (LICOs) are income thresholds that vary according to family and community size. Although LICOs are often referred to as poverty lines, they have no official status as such.
- Neighbourhood unemployment rate for population aged 15 and older participating in the labour force.

- Median household income in \$1,000s or the dollar amount above and below which half the cases fall.
- Males aged 15 to 24 years as a percentage of the total neighbourhood population. This age group represents the highest risk age group for offending. In Regina in 2001 about 48% of all identified accused were males aged 15 to 24 years.
- Percent of neighbourhood population aged 65 years and over. Results from the General Social Survey on Victimization suggest that Canadian rates of criminal victimization among the elderly are relatively low compared to the population as a whole (Gannon and Mihorean 2005).
- Percentage of the neighbourhood population immigrating to Canada between 1991 and 2001. Initially, immigration may hinder integration into society; however this condition decreases with the length of residence in the country (Breton 2003). Recent immigrants may be more likely to face reduced social participation and consequently reduced social capital or the benefits gained from relationships within the community. Numerous studies have demonstrated links between reduced levels of social participation and increased levels of crime (Morenoff et al. 2001; Sampson et al. 1997; Sampson 1997).
- Percentage of Aboriginal identity population living in the neighbourhood. Included are those persons who reported identifying with at least one Aboriginal group, that is, North American Indian, Métis or Inuit and/or who reported being a Treaty Indian or a Registered Indian, as defined by the Indian Act of Canada, and/or who reported they were members of an Indian Band or First Nation. The Aboriginal population in Canada is over represented with respect to victimization and offending. For instance, respondents to the GSS who self-identified as Aboriginal were 3 times as likely to report that they were victims of violent crimes than non-aboriginals (Brzozowski et al. 2006).
- Percentage of female lone-parent families among economic families living in private households.¹⁸ Although the after-tax income of female lone-parent families is increasing in Canada, these families continue to be among the lowest earners (Statistics Canada 2001c), and consequently may be concentrated in more disadvantaged areas of the city. Additionally, an increase in labour force participation among female lone-parents from 65% in 1995 to 82% in 2001 may have lead to decreased guardianship or supervision in neighbourhoods, which has been associated with higher crime rates (Cohen and Felson 1979).
- Percentage of population in a neighbourhood living at another residence one year prior to the Census. Residential mobility has been associated with higher crime rates through reduced guardianship or social involvement that frequent movers exhibit. For instance, studies of American cities indicate that streets where neighbours knew each other or felt responsible for their community had significantly lower rates of violent crime than those where social interaction was lower (Block 1979; Sampson 1993). In addition, results of the 2004 GSS indicate that rates of household victimization were highest among homes where the residents lived in their current dwelling for less than one year (Gannon and Mihorean 2005).

Dwelling characteristic variables

- Percentage of dwellings built before 1961. In combination with other variables related to signs of physical decay within urban neighbourhoods the age of buildings may be associated with higher crime rates through a perception of physical disorder (Kelling and Coles 1998).
- Percentage of dwellings in need of major repairs. Refers to whether, in the judgement of the respondent, the dwelling requires repairs (excluding desirable remodelling or additions) of defective plumbing or electrical wiring, structural repairs to walls, floors or ceilings, etc. This variable may similarly be associated with higher crime rates through the perception of physical disorder in the neighbourhood (Kelling and Coles 1998).
- Percentage of households spending more than 30% of total household income on shelter, including both owner-occupied and tenant-occupied households. This is a measure of housing affordability. The 30% figure is based on research indicating that when the shelter costs of low income households exceed 30% of their income, their consumption of other life necessities is reduced. Shelter expenses include payments for electricity, oil, gas, coal, wood or other fuels, water and other municipal services, mortgage payments, property taxes, condominium fees and rent. Decreased housing affordability within a neighbourhood is another indicator of socio-economic disadvantage.
- Percentage of owner-occupied dwellings in the neighbourhood. Collective dwellings are excluded from both the numerator and denominator. Greater proportions of owner-occupied housing in a neighbourhood may increase residential stability, social involvement among neighbours and a collective commitment to the neighbourhood. Results of the 2003 GSS indicate that high proportions of people who have lived in a neighbourhood for less than a year report knowing no one or only a few people in their immediate neighbourhood (Schellenberg 2004). Newcomers to a neighbourhood are also more likely to report having a somewhat or very weak sense of belonging to their local community as compared to those who have lived there 5 years or more (48% and 27 % respectively). According to the 2004 GSS, rates of household victimization are higher among renters (267 incidents per 1,000 households, compared to 242 for owned dwellings) (Gannon and Mihorean 2005).

City land-use variables

- **Commercial zoning** – the proportion of square area within a neighbourhood zoned for commercial land-use. Types of land-use falling under commercial zoning include stores, supermarkets, discount stores, furniture stores, banks, hotels, beverage hotels (licensed off-sales beer vendors), motels, restaurants, service garages, service stations, auto dealers, car washes, residential/commercial split properties and commercial offices. For the purpose of analysis the proportion of commercial zoning has been grouped into five equal categories.
- **Multiple-family residential zoning** – the proportion of square area within a neighbourhood zoned for multiple-family, two-family (duplex) or transitional dwellings which include short- and longer-term subsidized housing for those in need.

- **Single-family residential zoning** – the proportion of square area within a neighbourhood zoned for single-family dwellings.

What is Geocoding?

Geocoding is the process of matching a particular address with a geographic location on the Earth's surface. In this study the address corresponds to the location of criminal incidents reported to the Regina police. Prior to the geocoding process, the Regina crime incident data were reviewed for possible errors. The database contained crime incident records with an address field for the location of a particular crime incident. Changes in the address field were necessary in order to maintain a level of standardized address reporting. In some cases, the address field would contain notes or comments regarding the location of a particular incident. In these cases the notes were removed and the original address was left for geocoding. In addition, street type such as Roads, Bays and or Crescent abbreviations were standardized with the street type abbreviations in the Statistics Canada 2001 Road Network File (RNF) attribute table. These changes improved the geocoding process for matching addresses with the RNF.

In order to locate the geographic location of an address for each crime incident, a geocoding service was created using ArcGIS software. The geocoding service must refer to at least one data source that has both address information (attributes) and spatial information (geometry). The Road Network File (RNF) for the city of Regina was used as the feature class that included the data source for both types of information. When geocoding a particular address, the geocoding service searches through the features in the reference data feature class to find the feature with address attributes that most closely match the address. The geometry of the matching feature (RNF) is then used to create geometry for the address (X and Y coordinates of the incident).

Mapping techniques

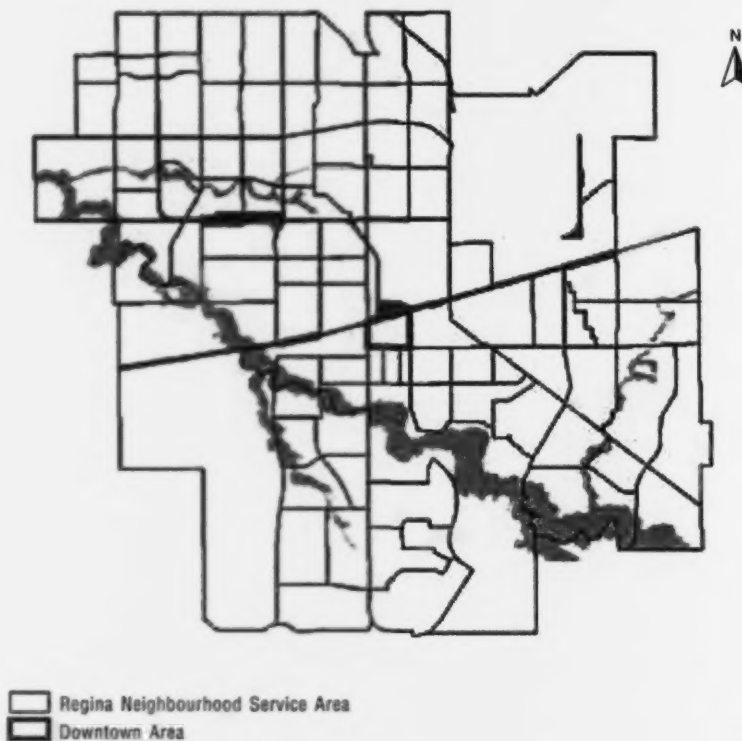
Two methods of displaying crime and other information are used in this study. First, data are displayed as a total for each Neighbourhood Service area (NSA) (see definition in text box entitled Neighbourhood Service Areas), and second, the pattern of points (individual criminal incidents) is displayed across the City of Regina to indicate the location of high density crime locations or "hot spots".

Neighbourhood Service Areas

The 95 'neighbourhoods' in this study reflect Neighbourhood Service Areas (NSAs) (Map 11 and Map 12). The NSA boundaries are based on 30 previously existing Community Association areas which have divided the City of Regina for the past three decades and have populations from 2,000 to 18,000 people. The NSAs were established in 2001 to create a common geography that could be used by the City and its partners for service development and planning at the neighbourhood and sub-neighbourhood level. The boundaries are based on the collective knowledge of many local agencies that helped to establish these and other geographies including the inner city.

Map 11

Neighbourhood Service Area boundaries, Regina, 2001



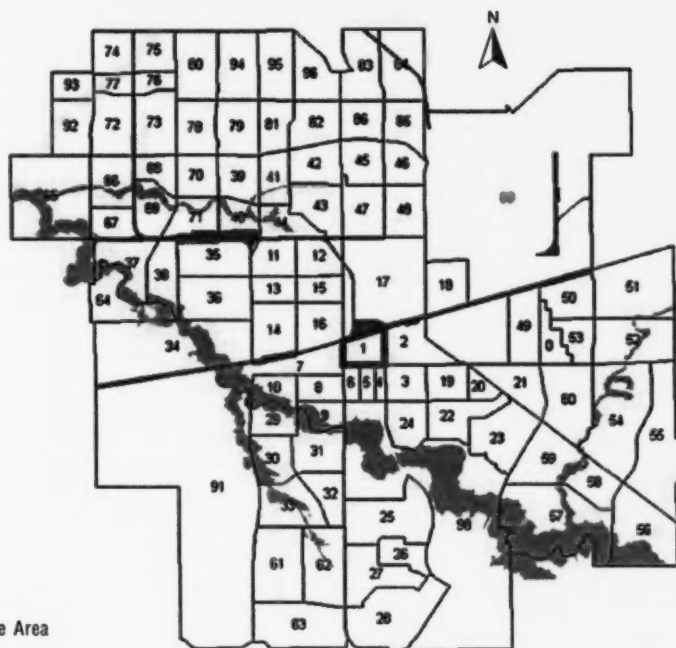
Source : Urban Planning Division, City of Regina, 2001.

Map 12

Map of Regina Neighbourhood Service Areas

Regina neighborhood service areas

Glen Elm 2	0	Coronation Pk 4	44	Albert Pk 1	61	Walsh Acres 4	78
Downtown	1	Northeast 1	45	Albert Pk 2	62	Walsh Acres 3	79
Core 1	2	Northeast 2	46	Albert Pk 3	63	Walsh Acres 1	80
Core 2	3	Northeast 3	47	Dieppe	64	Argyle Pk 1	81
Transitional 3	4	Northeast 4	48	Prairie View 1	65	Argyle Pk 1	82
Transitional 2	5	Glen Elm 1	49	Prairie View 2	66	Uplands 1	83
Transitional 1	6	Glencairn 1	50	Prairie View 3	67	Uplands 2	84
Cathedral 1	7	Glencairn 2	51	Norman View W 1	68	Uplands 3	85
Cathedral 3	8	Glencairn 3	52	Norman View W 2	69	Uplands 4	86
Cathedral 4	9	Glencairn 4	53	Normanview 1	70	Non-Res 5	89
Cathedral 2	10	Arcola 2	54	Normanview 2	71	Airport Non-Res	91
North Central 1	11	Arcola 3	55	Sherwood McCarthy 1	72	Non-Res 2	92
North Central 2	12	Arcola 6	56	Sherwood McCarthy 2	73	Non-Res 1	93
North Central 3	13	Arcola 7	57	Twin Lakes 1	74	Walsh Acres 2	94
North Central 4	14	Arcola 5	58	Twin Lakes 2	75	Non-Res 3	95
North Central 5	15	Arcola 4	59	Twin Lakes 4	76	Non-Res 4	96
North Central 6	16	Arcola 1	60	Twin Lakes 3	77	Wascana-University	98
North Central 7	17						
Eastview	18						
Al Ritchie 1	19						
Al Ritchie 2	20						
Al Ritchie 3	21						
Al Ritchie 4	22						
Boothill	23						
Gladmer Pk	24						
Hillsdale 1	25						
Hillsdale 2	26						
Whitmore Pk 1	27						
Whitmore Pk 2	28						
Lakeview 1	29						
Lakeview 2	30						
Lakeview 3	31						
Lakeview 5	32						
Lakeview 4	33						
McNab	34						
Rosemont MR 3	35						
Rosemont MR 4	36						
Rosemont MR 1	37						
Rosemont MR 2	38						
Regent Pk 1	39						
Regent Pk 2	40						
Coronation Pk 1	41						
Coronation Pk 2	42						
Coronation Pk 3	43						



Source : Urban Planning Division, City of Regina, 2001.

Boundaries were defined based on information about housing and existing neighbourhoods, natural conditions such as rivers and streams, transportation routes (rail lines and major roadways), and land use (residential, commercial and industrial). NSAs are typically smaller and more socio-demographically homogeneous than Statistics Canada's neighbourhood level geographies (i.e., Census Tracts) and more accurately match boundaries used by the City and others to direct programs. The smaller size of the NSA units makes them a critical geography for many Regina groups and they have effectively become the standard for assessing neighbourhood issues.

Mapping NSAs

By combining the crime incident codes with an X and Y value which represent the incident's longitude and latitude, point distributions were generated for specific crime types, year, and other data from the UCR database. Using the Geographic Information System (GIS), point data were overlaid on top of NSAs. Crime incidents were then calculated as a total for each NSA.

Mapping "hot spots": Kernel analysis

Kernel analysis is an alternative method of making sense of the spatial distribution of crime data. The method makes it possible to examine crime incident point data across neighbourhood boundaries and to see natural distributions and the location of concentrations of incidents. The goal of kernel analysis is to estimate how the density of events varies across a study area based on a point pattern. Kernel estimation was originally developed to estimate probability density from a sample of observations (Bailey and Gatrell, 1995). When applied to spatial data, kernel analysis creates a smooth map of density values in which the density at each location reflects the concentration of points in a given area.

In kernel estimation, a grid is overlaid on the study area. Distances are measured from the centre of a grid cell to each observation that falls within a predefined region of influence known as a bandwidth. The grid cell size for single kernel estimation in this study was determined based on the search radius measured for each set of point data. This resulted in an average grid cell size of less than 50 metres squared. Each observation contributes to the density value of that grid cell based on its distance from the centre. Nearby observations are given more weight in the density calculation than those farther away.

The product of the kernel estimation method is a simple matrix of dots (raster image) displaying contours of varying density. Contour loops define the boundaries of hot spot areas. Hot spots may be irregular in shape, and they are not limited by neighbourhood or other boundaries. This method of analysis was applied using *Environmental Systems Research Institute (ESRI) Spatial Analyst* software.

The dual kernel method is also used in this study in order to examine the distribution of two variables simultaneously (for example crime and socio-economic disadvantage). The dual kernel method was applied using CrimeStat 2.0 spatial statistics modelling software. Grid cell size was predefined by generating a survey grid of the study area based on the distribution of points within the entire NSA region.

Endnotes

1. Neighbourhood characteristics and the distribution of crime in Winnipeg by Fitzgerald, Wisener and Savoie was released in 2004, and Neighbourhood characteristics and the distribution of crime on the Island of Montreal by Savoie, Bédard and Collins was released in 2006.
2. Data are from a custom run by the Small Area and Administrative Data division of Statistics Canada, as derived from the annual taxfile received from the Canada Revenue Agency.
3. These population figures are based on the Statistics Canada *Census Metropolitan Area (CMA)* population for Regina, and are used for national comparative purposes. The CMA boundary includes adjacent municipalities situated around the urban core and is consequently larger than the study area which covers 95 NSAs within the municipality of Regina; consequently population figures for the study area are lower, totaling 175,605 residents in 2001.
4. Information in maps in this report is typically displayed in 7 categories or classes. Classes are based on natural groupings of data values. Arcmap identifies break points by looking for groupings and patterns inherent in the data. The features are divided into classes whose boundaries are set where there are relatively large jumps in the data values.
5. The highest reported violent and property crime neighbourhoods in 2001 were North Central 2, North Central 3, North Central 5, North Central 6 and Core 1.
6. For a full discussion please refer to Neighbourhood characteristics and the distribution of crime in Winnipeg by Fitzgerald, Wisener and Savoie.
7. Findings in this study are not intended to suggest that certain neighbourhood characteristics are the cause of crime, but rather they suggest that these factors are associated with or co-occur with higher crime rates in neighbourhoods.
8. For reasons of confidentiality and reliability, Statistics Canada requires that when using individual, family or household income data, the population size for any Canadian geographic area being considered must be at least 250 people who are residing in at least 40 private households.
9. Dichotomous variables are used only for the descriptive or bivariate analysis. The multivariate analysis that follows this section is based on continuous dependent variables: violent and property crime rates.
10. Ordinary least squares (OLS) regression is used in this study to examine the distribution of violent and property crime rates as a function of the set of explanatory factors. This method requires a continuous or quantitative outcome variable which is normally distributed, in this case crime rate. Since the distribution of crime rates is often skewed with a small proportion of neighbourhoods accounting for a larger proportion of reported incidents, it was necessary to log transform the violent crime variable.
11. Multicollinearity can distort a model by over inflating the predictive ability of the model and the significance of the model variables.
12. The presence of spatial autocorrelation was tested using the Moran's I statistic (insert value and sig).
13. The reader is cautioned that this does not take inflation into consideration.
14. For the purposes of this analysis, high-earners are defined as those earning \$50,000 or more in a year. In 1999, 15% of taxfilers in Regina reported earning that much, and by 2003 the proportion was 20%.
15. The neighborhoods with the highest proportions of high earners in either year were Albert Park, Arcola, Hillsdale, Lakeview, Prairie View, Twin Lakes, Walsh Acres and Whitmore Park.
16. The neighborhoods with the highest proportions of high earners in 1999 were Albert Park, Arcola, Hillsdale, Lakeview, Prairie View Twin Lakes and Walsh Acres and the highest proportion of high-earners in 2003 were Arcola, Hillsdale, Lakeview, Prairie View Twin Lakes, Walsh Acres and Whitmore Park.
17. The significance of the two-sample t-test was 0.06.
18. Economic family is defined as a group of two or more persons who live in the same dwelling and are related to each other by blood, marriage, common-law or adoption.

Bibliography

- Bailey, T.C. and A.C. Gatrell. 1995. *Interactive Spatial Data Analysis*. Reading, MA: Addison-Wesley
- Block, R.L. 1979. "Community, Environment, and Violent Crime." *Criminology*. 17: 46-57.
- Bowers, K.J., S.D. Johnson and K. Pease. 2004. "Prospective Hot-Spotting." *British Journal of Criminology*. 44: 641-658.
- Boyle, M.H. and E.L. Lipman. 2002. "Do Places Matter? Socioeconomic Disadvantage and Behavioral Problems of Children in Canada." *Journal of Consulting and Clinical Psychology*. 70(2): 378-389.
- Brantingham, P.L. and P.J. Brantingham. 1982. "Mobility, Notoriety and Crime: A Study of Crime Patterns in Urban Nodal Points." *Journal of Environmental Systems*. 11: 89-99.
- Brantingham, P.L. and P.J. Brantingham. 1984. *Patterns in Crime*. New York: Macmillan.
- Brantingham, P.L. and P.J. Brantingham. 1998. "Mapping Crime for Analytic Purposes: Location Quotients, Counts, and Rates." In D. Weisburd and T. McEwen (eds.). *Crime Mapping and Crime Prevention*. Monsey, N.Y.: Criminal Justice Press at 263.
- Breton, R. 2003. "Social Capital and the Civic Participation of Immigrants and Members of Ethno-Cultural Groups." Paper presented at the Policy Research Initiative Conference on The Opportunities and Challenges of Diversity: A Role for Social Capital? Montreal, November, 2003.
- Brown, M.A. 1982. "Modelling the Spatial Distribution of Suburban Crime." *Economic Geography*. 58(3): 247-261.
- Brzozowski, J., Taylor-Butts, A. and S. Johnson, 2006. "Victimization and Offending Among the Aboriginal Population in Canada" *Juristat*. Catalogue no. 85-002-XPE, Vol. 26, no. 3. Canadian Centre for Justice Statistics. Ottawa: Statistics Canada.
- Bursik (Jr.), R.J. 1988. "Social Disorganization and Theories of Crime and Delinquency: Problems and Prospects." *Criminology*. 26: 519-551.
- Carroll, L. and P.I. Jackson. 1983. "Inequality, Opportunity, and Crime Rates in Central Cities." *Criminology*. 21(2): 178-194.
- Cohen, L. and M. Felson. 1979. "Social Change and Crime Rates." *American Sociological Review*. 44: 588-608.
- Cordy, C.B. and D.A. Griffith. 1993. "Efficiency of Least Squares Estimators in the Presence of Spatial Autocorrelation." *Communications in Statistics, Series B*. 22(4): 1161-1179.

- Fitzgerald, R., M. Wisener and J. Savoie. 2004. "Neighbourhood Characteristics and the Distribution of Crime in Winnipeg." *Canadian Centre for Justice Statistics Crime and Justice Research Paper Series*. Catalogue no. 85-561-MIE – no. 004. Ottawa: Canadian Centre for Justice Statistics, Statistics Canada.
- Gannon, M. and K. Mihorean. 2005. "Criminal Victimization in Canada, 2004." *Juristat*. 25(7). Catalogue no. 85-002-XPE. Ottawa: Statistics Canada.
- Getis, A. 1991. "Spatial Interaction and Spatial Autocorrelation: A Cross-product Approach." *Environment and Planning A*. 23: 1269-1277.
- Grob, J. 2003. "Regression Diagnostics." In *Linear Regression – Lecture Notes in Statistics no. 175*. P. Bickel et al (eds.). Berlin: Springer-Verlag.
- Haining, R.P. 2001. "Spatial Autocorrelation." *International Encyclopedia of the Social and Behavioural Sciences*, at 14763-14768.
- Heisz, A. 2005. "Ten Things to Know About Canadian Metropolitan Areas: A synthesis of Statistics Canada's Trends and Conditions in Census Metropolitan Areas Series." *Analytical Paper, Trends and Conditions in Census Metropolitan Areas series*. Catalogue no. 89-613-MIE – No.009. Ottawa: Statistics Canada.
- Hou, F. and J. Myles. 2005. "Neighbourhood Inequality, Neighbourhood Affluence and Population Health." *Social Science & Medicine*. 60: 1557-1569.
- Kawachi, I., B.P. Kennedy and R.G. Wilkinson. 1999. "Crime: Social Disorganization and Relative Deprivation." *Social Science & Medicine*. 48: 719-731.
- Kelling, G. and C. Coles. 1998. *Fixing Broken Windows: Restoring Order and Reducing Crime in Our Communities*. New York, NY: Touchstone.
- Land, K.C., P.L. McCall and L.E. Cohen. 1990. "Structural Covariates of Homicide Rates: Are There Any Invariances Across Time and Social Space?" *American Journal of Sociology*. 95: 922-963.
- Lichstein, J.W., T.R. Simons, S.A. Shriver and K.E. Franzreb. 2002. "Spatial Autocorrelation and Autoregressive Models in Ecology." *Ecological Monographs*. 72(3): 445-463.
- Luo, Z., W.J. Kierans, R. Wilkins, R.M. Liston, J. Mohamed and M.S. Kramer. 2004. "Disparities in Birth Outcomes by Neighbourhood Income: Temporal Trends in Rural and Urban Areas, British Columbia." *Epidemiology*. 15(6): 679-686.
- Marshall, R.J. 1991. "A Review of Methods for the Statistical Analysis of Spatial Patterns of Disease." *Journal of the Royal Statistical Society, Series A*. 154(3): 421-441.
- Montgomery, Douglas C., Elizabeth A. Peck and G. Geoffrey Vining. 2001, *Introduction to Linear Regression Analysis*, 3rd Edition, New York, New York, John Wiley & Sons.
- Morenoff, J.D. and R.J. Sampson. 1997. "Violent Crime and the Spatial Dynamics of Neighbourhood Transition: Chicago, 1970-1990." *Social Forces*. 76(1): 31-64.
- Morenoff, J.D., R.J. Sampson and S.W. Raudenbush. 2001. "Neighbourhood inequality, collective efficacy and the spatial dynamics of urban violence." *Research Report*. Report No. 00-451. University of Michigan: Population Studies Centre at the Institute for Social Research.

- Obberwittler, D. In press. "Re-Balancing Routine Activity and Social Disorganization Theories in the Explanation of Urban Violence: A New Approach to the Analysis of Spatial Crime Patterns Based on Population at Risk." *Journal of Quantitative Criminology*.
- Pagani, L., B. Boulerice, F. Vitaro and R.E. Tremblay. 1999. "Effects of Poverty on Academic Failure and Delinquency in Boys: A Change and Process Model Approach." *Journal of Child Psychology and Psychiatry*. 40(8): 1209-1219.
- Picot, G. and J. Myles. 2005. "Income Inequality and Low Income in Canada: An International Perspective." *Analytical Studies Branch Research Paper Series*. Catalogue no. 11F0019MIE – No. 240. Ottawa: Statistics Canada.
- Putnam, R.D. 2001. *Bowling Alone: the Collapse and Revival of American Community*. New York, NY: Touchstone.
- Ratcliffe, J.H. 2002. "Damned if You Don't, Damned if You Do: Crime Mapping and its Implications in the Real World." *Policing and Society*. 12 (3): 211-225.
- Roncek, D.W. and P.A. Maier. 1991. "Bars, Blocks, and Crimes Revisited: Linking the Theory of Routine Activities to the Empiricism of Hot Spots." *Criminology*. 29: 725-755.
- Ross, N.A. 2004. *What Have We Learned Studying Income Inequality and Population Health?* Ottawa: Canadian Institute for Health Information.
- Sampson, R.J. 1993. "The Community Context of Violent Crime." In W.J. Wilson (ed.) *Sociology and the Public Agenda* at 274-279. Newbury Park, CA: Sage Publications.
- Sampson, R.J. 1997. "The Embeddedness of Child and Adolescent Development: A Community-Level Perspective on Urban Violence." In J. McCord (ed.) *Violence and Childhood in the Inner City*. Cambridge, UK: Cambridge University Press.
- Sampson, R.J. and J.L. Lauritsen. 1994. "Violent Victimization and Offending: Individual-, Situational-, and Community-level risk factors." In A.J. Reiss and J.A. Roth (eds.) *Understanding and Preventing Violence*. Washington, DC: National Academy Press.
- Sampson, R.J. and S. Raudenbush. 1999. "Systematic Social Observation of Public Spaces: A New Look at Disorder in Urban Neighbourhoods." *American Journal of Sociology*. 105: 603-651.
- Sampson, R.J., S.W. Raudenbush and F. Earls. 1997. "Neighbourhoods and Violent Crime: A Multilevel Study of Collective Efficacy." *Science*. 277: 918-924.
- Savoie, Josée, Frédéric Bédard and Krista Collins. 2006, "Neighbourhood Characteristics and the Distribution of Crime on the Island of Montréal", *Canadian Centre for Justice Statistics Crime and Justice Research Paper Series*. Catalogue no. 85-561-MIE – no. 007. Ottawa: Canadian Centre for Justice Statistics, Statistics Canada.
- Schellenberg, G. 2004. "2003 General Social Survey on Social Engagement, cycle 17: An Overview of Findings." Catalogue no. 89-598-XIE. Ottawa: Statistics Canada.
- Shaw, C.R. and H.D. McKay. 1942. *Juvenile Delinquency in Urban Areas*. Chicago, IL: University of Chicago Press.

- Sherman, L.W., P.R. Gartin and M.E. Buerger. 1989. "Hot Spots of Predatory Crime: Routine Activities and the Criminology of Place." *Criminology*. 27(1): 27-55.
- Siggner, A.J. and R. Costa. 2005. "Aboriginal Conditions in Census Metropolitan Areas, 1981-2001." *Analytical Paper, Trends and Conditions in Census Metropolitan Areas series*. Catalogue no. 89-613-MIE – No.008. Ottawa: Statistics Canada.
- Statistics Canada. 2001. *Income in Canada*. Catalogue no. 75-202-XIE. Ottawa: Statistics Canada.

Appendices

Appendix A

Map 13

Kernel density distribution of drug incidents, Regina, 2001

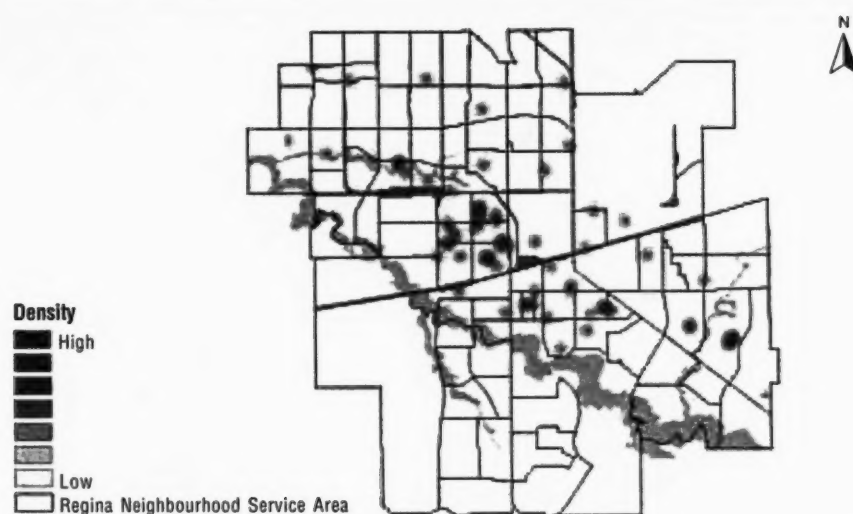


Based on 225 drug incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 14

Kernel density distribution of arson incidents, Regina, 2001

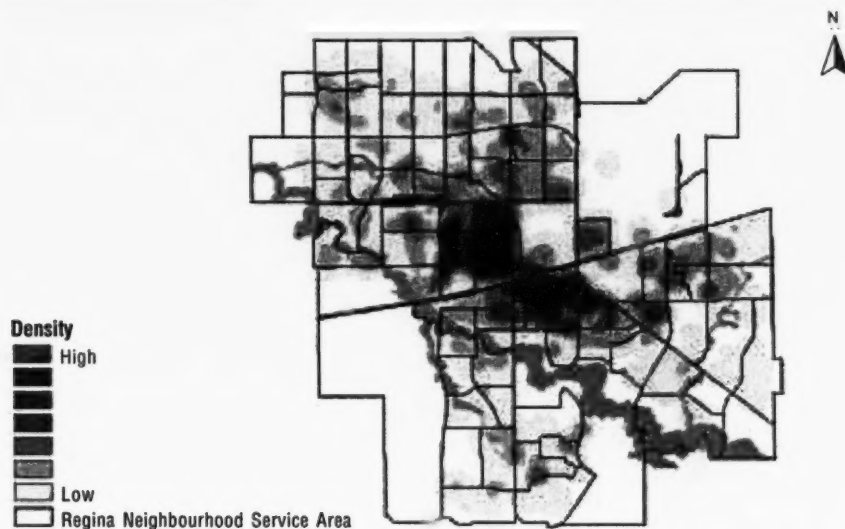


Based on 76 arson incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 15

Kernel density distribution of common assault incidents, Regina, 2001

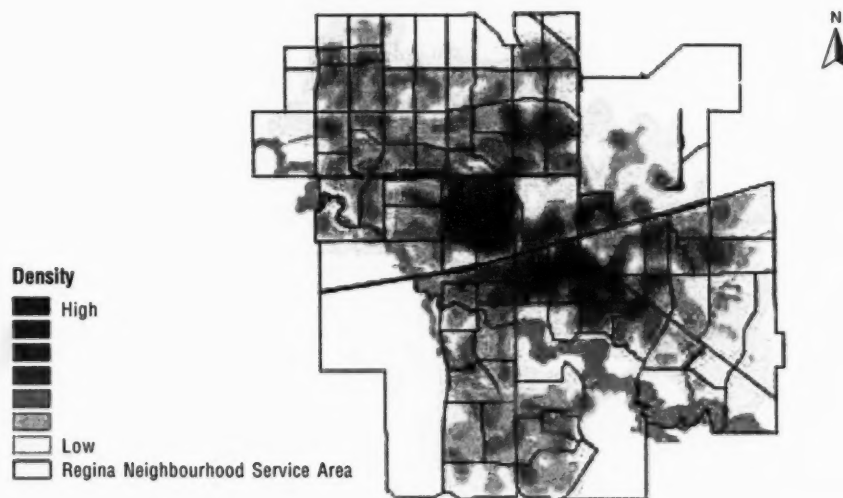


Based on 1,387 common assault incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 16

Kernel density distribution of break and enter incidents, Regina, 2001



Based on 3,775 break and enter incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 17

Kernel density distribution of car theft incidents, Regina, 2001



Based on 3,782 car theft incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 18

Kernel density distribution of homicide and serious assault incidents, Regina, 2001



Based on 787 homicide and serious assault incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 19

Kernel density distribution of mischief incidents, Regina, 2001



Based on 3,312 mischief incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 20

Kernel density distribution of prostitution incidents, Regina, 2001

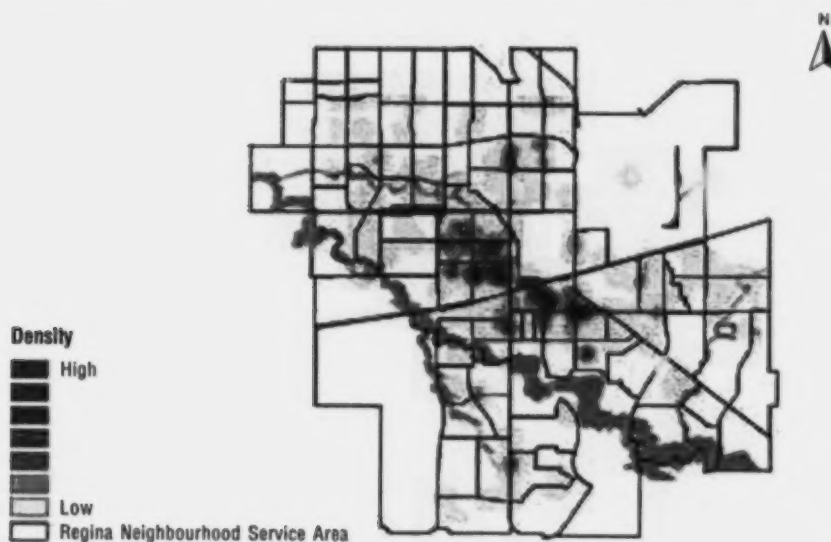


Based on 75 prostitution incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 21

Kernel density distribution of robbery incidents, Regina, 2001

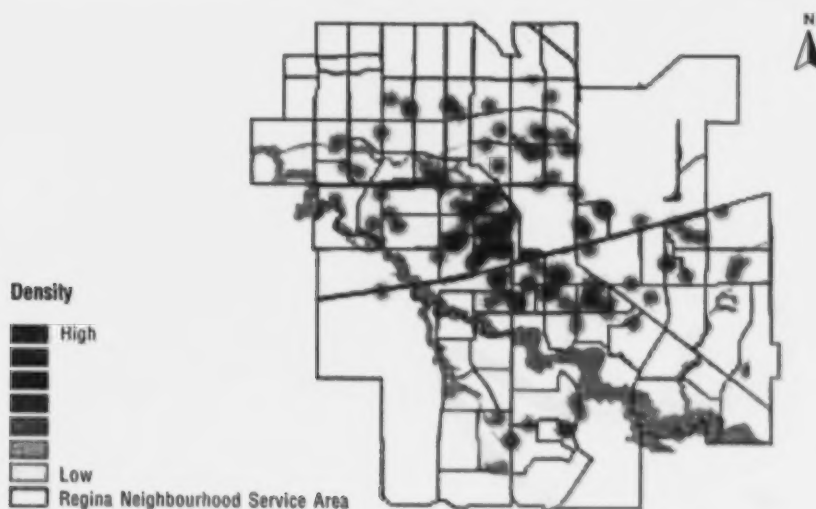


Based on 366 robbery incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 22

Kernel density distribution of sexual assault incidents, Regina, 2001

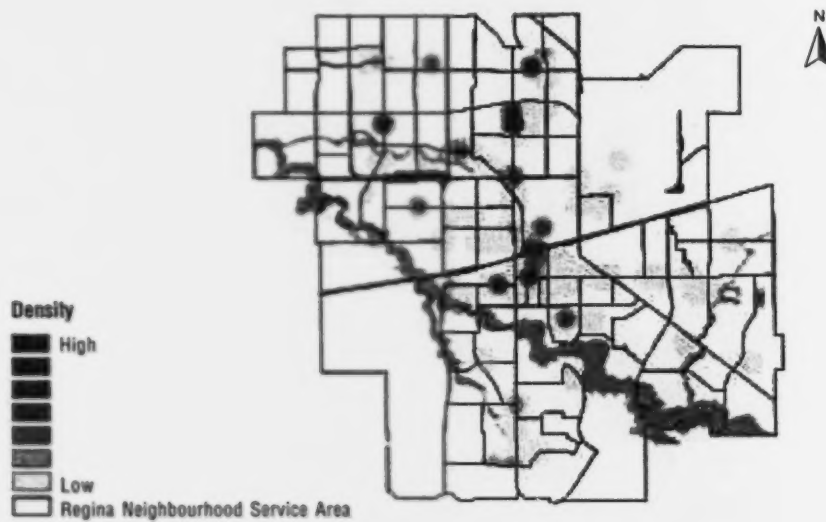


Based on 173 sexual assault incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 23

Kernel density distribution of shoplifting incidents, Regina, 2001



Based on 892 shoplifting incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 24

Kernel density distribution of theft over \$5,000 incidents, Regina, 2001

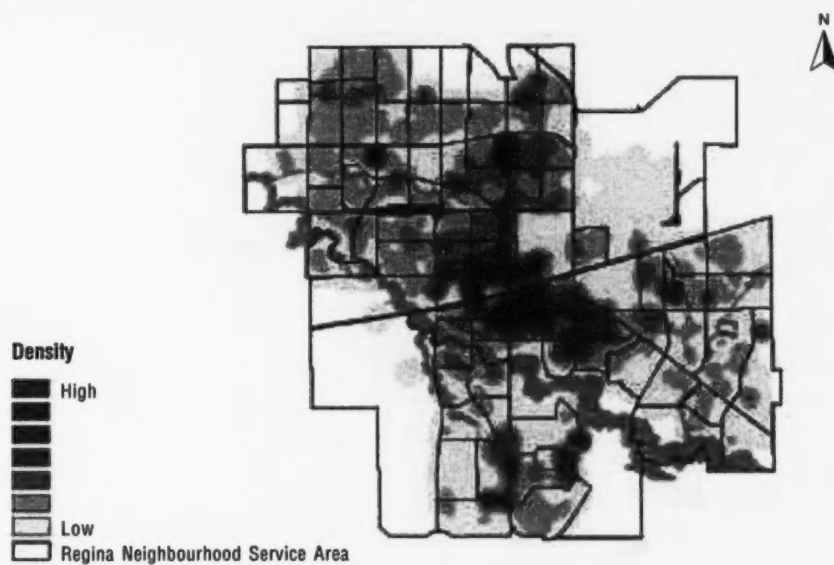


Based on 837 theft over \$5,000 incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Map 25

Kernel density distribution of theft under \$5,000 incidents, Regina, 2001



Based on 13,697 theft under \$5,000 incidents.

Source: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey, 2001.

Appendix B

Table B.1

Selected offence types for highest need Neighbourhood Service Areas (NSAs), Regina, 2001

NSAs	Total incidents ²		Total violent crime ³		Total property crime ³		Common assault ¹		Break and enter ¹		Car theft ¹		Mischief ¹		Theft under \$5,000 ¹	
	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹
Average for Regina (87 NSAs)²	269	101	36	14	226	85	16	6	41	16	42	16	37	14	152	55
Al Ritchie 1	481	199	73	30	395	163	30	12	80	33	85	35	66	27	269	111
Al Ritchie 2	118	124	20	21	93	98	8	8	27	28	15	16	10	11	59	62
Al Ritchie 3	462	137	62	18	392	116	33	10	56	17	97	29	76	23	248	74
Al Ritchie 4	358	127	28	10	327	116	15	5	88	31	77	27	45	16	202	72
Albert Pk 1	145	45	7	2	137	42	x	1	51	16	20	6	28	9	71	22
Albert Pk 2	583	79	36	5	538	73	18	2	62	8	115	16	70	10	390	53
Albert Pk 3	323	70	13	3	307	66	8	2	27	6	91	20	51	11	189	41
Arcola 1	163	38	x	1	159	37	x	0	31	7	12	3	31	7	104	24
Arcola 2	228	39	14	2	212	36	6	1	29	5	28	5	41	7	157	27
Arcola 3	183	49	12	3	168	45	5	1	12	3	11	3	33	9	138	37
Arcola 4	162	54	11	4	150	50	x	1	25	8	27	9	39	13	87	29
Arcola 5	64	35	x	1	63	35	x	0	6	3	9	5	15	8	47	26
Arcola 6	43	20	x	0	43	20	x	0	6	3	x	2	5	2	35	17
Arcola 7	41	25	x	1	39	24	x	1	7	4	x	2	11	7	36	22
Argyle Pk 1	119	61	28	14	90	46	16	8	15	8	20	10	17	9	66	34
Argyle Pk 2	166	74	20	9	144	64	8	4	28	12	29	13	23	10	90	40
Boothill	265	87	23	8	242	80	7	2	63	21	44	15	38	13	126	42
Cathedral 1	574	115	65	13	497	99	25	5	66	13	103	21	79	16	331	66
Cathedral 2	149	123	12	10	134	110	7	6	26	21	26	21	24	20	88	72
Cathedral 3	382	111	48	14	330	95	20	6	43	12	62	18	40	12	232	67
Cathedral 4	75	59	x	2	72	56	x	1	24	19	9	7	8	6	39	30
Core 1	1,162	277	259	62	794	189	90	21	189	45	120	29	110	26	504	120
Core 2	565	93	109	18	439	72	48	8	67	11	99	16	68	11	249	41
Coronation Pk 1	144	106	17	13	125	92	7	5	34	25	17	13	23	17	73	54
Coronation Pk 2	416	176	37	16	373	158	20	8	36	15	77	33	53	22	286	121
Coronation Pk 3	325	106	41	13	276	90	23	7	52	17	58	19	32	10	192	63
Coronation Pk 4	235	135	38	22	194	111	16	9	18	10	33	19	33	19	142	82
Dieppe	165	79	27	13	136	65	15	7	29	14	31	15	28	13	67	32
Downtown	918	63	141	10	751	52	64	4	73	5	70	5	91	6	786	54
Eastview	298	141	60	28	233	110	27	13	61	29	52	25	33	16	110	52
Gladmer Pk	223	115	18	9	196	101	7	4	13	7	25	13	34	18	185	95
Glen Elm 1	333	139	40	17	290	121	19	8	69	29	47	20	50	21	158	66
Glen Elm 2	223	158	31	22	191	135	16	11	16	11	48	34	33	23	147	104
Glencairn 1	170	60	30	11	137	48	15	5	36	13	33	12	20	7	75	26
Glencairn 2	272	48	30	5	237	41	13	2	39	7	38	7	43	8	130	23
Glencairn 3	286	92	40	13	239	77	19	6	49	16	34	11	55	18	154	50
Glencairn 4	232	119	25	13	206	105	10	5	44	23	35	18	28	14	138	71
Hillsdale 1	201	39	7	1	193	37	x	0	45	9	30	6	35	7	104	20
Hillsdale 2	330	135	13	5	314	128	10	4	23	9	66	27	41	17	281	115
Lakeview 1	149	125	13	11	135	113	9	8	16	13	26	22	26	22	94	79
Lakeview 2	87	66	x	2	85	65	x	1	22	17	20	15	14	11	38	29
Lakeview 3	192	71	24	9	164	61	8	3	32	12	33	12	36	13	101	37
Lakeview 4	103	49	6	3	96	46	x	1	39	19	10	5	17	8	48	23
Lakeview 5	82	51	5	3	75	47	x	2	22	14	10	6	9	6	49	31
McNab	172	57	25	8	146	48	12	4	23	8	52	17	18	6	74	24
Normanview 1	111	62	17	9	93	52	8	4	21	12	18	10	15	8	48	27
Normanview 2	221	85	28	11	191	73	15	6	36	14	61	23	31	12	108	41
Normanview W 1	231	124	19	10	212	114	10	5	30	16	28	15	22	12	172	92
Normanview W 2	138	61	15	7	122	54	7	3	26	11	17	8	31	14	80	35

Table B.1 – concluded

Selected offence types for highest need Neighbourhood Service Areas (NSAs), Regina, 2001

NSAs	Total incidents ¹		Total violent crime ²		Total property crime ³		Common assault 1 ⁴		Break and enter ⁴		Car theft ⁴		Mischief ⁴		Theft under \$5,000 ⁴	
	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹	count	rate ¹
North Central 1	353	218	78	48	262	162	31	19	73	45	69	43	55	34	105	65
North Central 2	609	284	160	75	436	203	81	38	112	52	97	45	102	48	171	80
North Central 3	515	305	115	68	381	226	48	28	112	66	81	48	66	39	190	113
North Central 4	507	161	101	32	391	125	47	15	69	22	99	32	66	21	248	79
North Central 5	689	328	202	96	423	202	82	39	111	53	84	40	80	38	200	95
North Central 6	983	326	218	72	738	245	83	28	152	50	136	45	136	45	491	163
North Central 7	663	83	72	9	579	72	24	3	99	12	86	11	63	8	478	60
Northeast 1	516	157	45	14	469	143	15	5	41	12	79	24	65	20	382	116
Northeast 2	169	113	24	16	136	91	11	7	35	23	24	16	15	10	77	52
Northeast 3	457	146	58	19	386	123	27	9	62	20	70	22	48	15	293	94
Northeast 4	274	104	43	16	225	85	17	6	45	17	48	18	35	13	119	45
Prairie View 1	54	23	x	0	53	23	x	0	8	3	x	1	10	4	54	23
Prairie View 2	158	65	9	4	148	61	x	2	38	16	28	12	21	9	89	37
Prairie View 3	113	59	9	5	103	53	5	3	19	10	23	12	14	7	72	37
Regent Pk 1	77	47	x	2	70	42	x	0	20	12	13	8	15	9	27	16
Regent Pk 2	165	127	31	24	130	100	9	7	32	25	33	25	25	19	55	42
Rosemont MR 1	155	86	11	6	143	79	5	3	19	11	18	10	32	18	93	51
Rosemont MR 2	159	89	18	10	140	78	6	3	38	21	22	12	30	17	70	39
Rosemont MR 3	284	106	39	15	241	90	20	7	39	15	64	24	29	11	153	57
Rosemont MR 4	375	119	39	12	324	103	15	5	60	19	96	30	54	17	161	51
Sherwood McCarthy 1	241	64	25	7	211	56	16	4	43	11	34	9	47	13	134	36
Sherwood McCarthy 2	266	71	26	7	238	64	11	3	50	13	40	11	44	12	168	45
Transitional 1	194	69	16	6	175	62	7	2	25	9	27	10	23	8	165	58
Transitional 2	297	65	26	6	263	58	12	3	21	5	56	12	34	7	232	51
Transitional 3	130	46	22	8	105	37	11	4	21	7	22	8	16	6	81	29
Twin Lakes 1	39	42	x	3	36	39	x	2	6	7	5	5	x	3	36	39
Twin Lakes 2	109	47	x	2	104	45	x	1	14	6	9	4	23	10	94	40
Twin Lakes 3	127	111	9	8	115	100	x	3	17	15	18	16	21	18	85	74
Twin Lakes 4	125	70	5	3	118	66	x	1	19	11	15	8	24	14	74	42
Uplands 1	242	203	15	13	226	189	6	5	29	24	18	15	17	14	204	171
Uplands 2	154	92	13	8	137	82	6	4	19	11	26	16	24	14	65	39
Uplands 3	80	73	12	11	68	62	6	5	14	13	16	15	13	12	35	32
Uplands 4	121	65	11	6	110	59	7	4	15	8	32	17	12	6	81	43
Walsh Acres 1	114	39	6	2	105	36	5	2	6	2	13	4	25	9	110	38
Walsh Acres 3	142	61	7	3	135	58	5	2	38	16	10	4	24	10	97	41
Walsh Acres 4	153	58	17	6	135	51	9	3	27	10	23	9	32	12	80	30
Whitmore Pk 1	301	77	33	8	260	67	9	2	43	11	32	8	61	16	184	47
Whitmore Pk 2	213	49	12	3	200	46	x	1	60	14	12	3	41	9	155	36

x suppressed to meet the confidentiality requirements of the *Statistics Act*

1. Rates per 1,000 residential and employed population.

2. Regina counts and rates based on the 87 neighbourhoods where the total residential population was over 250 people.

3. Includes most serious violation in each incident only.

4. Includes all recorded violations in each incident.

Sources: Statistics Canada, Canadian Centre for Justice Statistics, Incident-based Uniform Crime Reporting Survey and 2001 Census.

Table B.2

Selected Census characteristics for highest need Neighbourhood Service Areas (NSAs), Regina, 2001

NSAs	Popu- lation receiving gov't transfers	Popu- lation without high school certi- ficate	Popu- lation below low income cut-off	Unem- ployed popu- lation aged 15 and over	Median house- hold income	Per- cent immi- grant popu- lation	Abori- ginal popu- lation	Female lone- parent families	Recent movers (past year different address)	Housing built before 1961	Dwell- ings in need of major repairs	House- holds spending 30% or more on shelter	Popu- lation of males aged 15 to 24	Popu- lation aged 15 and over with Bach- elor's degree	Rented dwell- ings
	percentage				in \$1,000s	percentage									
Average percentage for Regina (87 NSAs) ¹	13	20	13	7	50	21	9	17	17	30	8	21	8	16	31
Al Ritchie 1	23	23	26	14	31	12	17	28	27	79	21	35	7	7	39
Al Ritchie 2	23	22	23	11	33	47	12	37	24	58	14	29	x	x	33
Al Ritchie 3	19	22	38	7	28	39	12	35	28	27	12	31	5	9	69
Al Ritchie 4	14	22	13	6	42	13	8	28	16	83	21	17	9	13	24
Albert Pk 1	9	13	x	5	75	18	x	6	8	x	x	11	6	29	15
Albert Pk 2	16	15	15	5	34	41	x	10	24	13	9	29	8	25	58
Albert Pk 3	8	13	x	5	60	13	x	9	15	x	x	17	7	33	36
Arcola 1	5	10	x	x	97	9	x	x	6	x	x	6	11	31	x
Arcola 2	7	12	x	x	68	x	x	12	12	x	x	19	8	23	23
Arcola 3	x	9	x	x	92	44	x	x	15	x	x	9	5	31	x
Arcola 4	7	16	x	5	72	x	x	x	12	x	x	15	10	27	25
Arcola 5	x	9	x	x	99	38	x	7	10	x	x	8	8	39	17
Arcola 6	x	11	x	x	113	26	x	x	14	x	x	15	9	39	x
Arcola 7	x	15	x	6	95	17	x	6	8	x	x	6	8	34	x
Argyle Pk 1	8	19	14	x	50	47	9	20	12	x	x	17	9	9	31
Argyle Pk 2	6	16	9	7	58	x	6	23	9	x	x	17	5	11	21
Boothill	15	21	7	8	48	20	5	10	11	70	10	19	7	13	15
Cathedral 1	16	18	20	9	28	22	16	27	18	62	17	31	7	16	55
Cathedral 2	14	14	12	x	37	18	6	17	14	91	23	19	x	28	19
Cathedral 3	11	11	15	10	35	24	6	27	27	67	16	31	7	34	56
Cathedral 4	6	9	x	x	73	14	x	7	10	85	13	14	8	48	10
Core 1	33	30	38	24	17	24	32	31	32	73	14	42	9	5	69
Core 2	26	24	28	9	20	18	15	24	29	56	13	48	8	15	77
Coronation Pk 1	16	27	x	5	51	8	6	16	x	12	7	12	5	8	12
Coronation Pk 2	20	31	13	6	34	25	12	14	16	9	7	21	6	5	57
Coronation Pk 3	17	29	8	7	42	33	8	17	13	47	8	23	6	7	29
Coronation Pk 4	23	29	39	12	28	17	16	39	27	26	11	35	8	9	63
Dieppe	12	24	14	x	51	11	9	23	19	8	14	17	6	14	18
Downtown	31	19	x	13	17	30	x	x	24	23	x	30	4	17	100
Eastview	25	23	31	12	28	13	22	27	21	50	18	37	7	x	37
Gladmer Pk	15	13	10	8	31	43	x	30	37	67	10	28	11	31	71
Glen Elm 1	17	33	18	6	36	13	11	21	21	30	10	19	8	x	32
Glen Elm 2	18	24	11	x	34	23	5	19	15	x	5	21	10	11	58
Glencairn 1	10	27	18	6	52	38	13	22	14	x	7	18	10	9	17
Glencairn 2	6	17	5	x	67	25	5	10	14	x	x	10	8	15	9
Glencairn 3	9	25	21	5	46	33	14	24	21	x	11	23	10	11	36
Glencairn 4	12	22	14	x	58	72	7	19	29	x	x	16	6	13	29
Hillsdale 1	13	12	8	x	59	20	x	12	13	44	6	19	6	35	21
Hillsdale 2	7	x	23	10	41	49	x	15	35	18	5	36	17	36	68
Lakeview 1	11	12	9	x	47	x	6	11	21	86	7	14	9	30	30
Lakeview 2	9	5	8	x	58	29	7	8	15	73	5	12	x	28	13
Lakeview 3	7	8	8	x	59	9	x	21	9	95	15	14	8	44	9
Lakeview 4	10	10	x	5	64	x	x	13	11	34	6	8	6	27	x
Lakeview 5	7	10	7	x	54	26	x	9	7	89	10	18	7	37	20
McNab	19	25	10	12	29	19	10	16	25	50	9	33	10	9	50
Normanview 1	8	20	x	x	65	x	x	12	11	x	8	7	8	15	x
Normanview 2	13	23	21	7	37	45	15	27	22	5	6	26	10	7	50
Normanview W 1	7	20	7	5	55	27	6	14	18	x	x	17	9	9	37
Normanview W 2	6	22	5	x	65	22	13	8	14	x	x	11	8	16	8
North Central 1	21	35	34	13	31	10	25	23	18	86	18	34	8	x	37
North Central 2	27	27	44	17	25	15	34	32	26	66	18	38	10	x	51
North Central 3	23	27	38	19	26	29	30	25	32	83	13	43	10	12	47
North Central 4	28	26	42	8	25	x	34	42	39	89	19	41	9	10	45

Table B.2 – concluded

Selected Census characteristics for highest need Neighbourhood Service Areas (NSAs), Regina, 2001

NSAs	Popu- lation receiving gov't transfers	Popu- lation without high school certi- ficate	Popu- lation below low income cut-off	Unem- ployed popu- lation aged 15 and over	Median house- hold income	Per- cent immi- grant popu- lation	Aborigi- nal popu- lation	Female lone- parent families	Recent movers (past year different address)	Housing built before 1961	Dwell- ings in need of major repairs	House- holds in spending 30% or more on shelter	Popu- lation of males aged 15 to 24	Popu- lation aged 15 and over with Bach- elor's degree	Rented dwell- ings
	percentage	percentage	percentage	percentage	in \$1,000s	percentage	percentage	percentage	percentage	percentage	percentage	percentage	percentage	percentage	percentage
North Central 5	31	30	54	17	23	8	40	36	33	74	19	41	6	x	54
North Central 6	26	27	40	16	23	47	44	30	36	78	20	43	9	6	64
North Central 7	20	38	31	8	31	x	33	21	30	75	21	33	x	10	50
Northeast 1	32	28	10	8	28	x	8	14	24	10	5	31	5	x	71
Northeast 2	14	26	11	x	50	x	x	20	6	17	5	17	6	5	18
Northeast 3	26	34	25	15	31	13	19	29	23	50	13	30	5	x	40
Northeast 4	23	29	25	11	35	x	25	26	22	56	17	26	9	x	31
Prairie View 1	x	13	x	x	88	24	x	7	11	x	x	11	8	18	x
Prairie View 2	5	16	5	5	71	19	x	8	14	x	x	13	12	17	25
Prairie View 3	5	16	x	7	67	54	7	13	8	x	x	6	10	11	9
Regent Pk 1	14	20	4	6	48	20	5	16	5	27	10	9	x	7	7
Regent Pk 2	22	29	28	10	36	x	27	20	17	37	12	21	6	9	35
Rosemont MR 1	8	25	8	5	52	x	13	20	13	x	5	14	7	10	20
Rosemont MR 2	11	23	5	x	59	x	x	13	7	15	x	8	9	9	10
Rosemont MR 3	17	23	20	8	41	16	14	23	18	74	7	23	6	8	33
Rosemont MR 4	15	23	19	10	38	37	9	21	22	84	18	26	8	10	27
Sherwood McCarthy 1	7	20	6	7	56	18	10	21	11	x	x	13	10	14	19
Sherwood McCarthy 2	6	21	x	x	60	13	13	16	13	x	5	10	8	9	16
Transitional 1	25	24	x	7	19	23	x	x	26	33	9	34	x	21	84
Transitional 2	19	24	20	8	24	31	x	5	30	28	x	29	7	18	87
Transitional 3	25	27	22	11	19	62	7	16	30	23	13	47	x	19	97
Twin Lakes 1	x	17	x	x	76	57	x	x	15	x	x	5	6	12	x
Twin Lakes 2	x	11	x	x	80	53	x	10	12	x	x	x	11	14	x
Twin Lakes 3	6	16	15	x	49	13	x	31	6	x	x	18	6	17	34
Twin Lakes 4	12	19	x	x	48	13	x	11	11	x	x	24	7	19	25
Uplands 1	10	25	x	7	73	33	x	5	8	x	x	x	9	6	x
Uplands 2	6	17	x	x	64	x	x	8	14	x	x	14	11	9	26
Uplands 3	6	26	5	x	60	x	8	11	5	x	x	10	8	13	10
Uplands 4	11	29	7	8	61	25	6	18	9	x	10	11	9	10	17
Walsh Acres 1	x	15	x	x	88	32	5	5	16	x	x	14	8	13	x
Walsh Acres 3	7	18	x	x	72	x	5	10	12	x	x	7	11	17	x
Walsh Acres 4	6	22	x	7	66	22	x	11	11	x	x	10	8	15	20
Whitmore Pk 1	9	15	5	x	59	24	x	11	11	47	6	18	8	34	24
Whitmore Pk 2	9	15	x	5	66	15	x	9	8	39	7	7	6	29	5

x suppressed to meet the confidentiality requirements of the *Statistics Act*

1. Regina figures based on the 87 neighbourhoods where the total residential population was over 250 people.

Source: Statistics Canada, 2001 Census.

Canadian Centre for Justice Statistics

Crime and Justice research paper series

Cumulative Index

The **Canadian Centre for Justice Statistics (CCJS)** was created in 1981 as a division of Statistics Canada. The CCJS is the focal point of a federal-provincial-territorial partnership for the collection of information on the nature and extent of crime and the administration of civil and criminal justice in Canada. This partnership, known as the "National Justice Statistics Initiative", has become the international model of success on how to develop, implement and manage an effective national justice statistics program. Its analytical output appears in the flagship publication *Juristat* (<http://www.statcan.ca/english/IPS/Data/85-002-XIE.htm>), in various annual and biennial publications, and in the *Crime and Justice research paper series* (<http://www.statcan.ca/english/IPS/Data/85-561-MIE.htm>).

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